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UNITED STATES DEPARTMENT OF ENERGY
STRATEGIC PETROLEUM RESERVE

PHASE I CERCLA REPORT: INSTALLATION ASSESSMENT

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Boeing
Petroleum
Services, Inc.

STRATEGIC PETROLEUM RESERVE

PHASE I CERCLA REPORT:

INSTALLATION ASSESSMENT

Prepared by Boeing Petroleum Services, Inc.

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US DOE SPR WEST HACKBERRY
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DISCLAIMER

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EXECUTIVE SUMMARY

This report was prepared on behalf of the Department of Energy (DOE) by Boeing Petroleum Services, Inc. (BPS), the management, operations and maintenance contractor to DOE for the Strategic Petroleum Reserve (SPR). DOE Order 5480.14 required all DOE-owned sites to achieve compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In accordance with the understanding reached between BPS and DOE, and as set forth in the letter dated March 28, 1985, DOE is the owner and operator of the SPR.

This report fulfills the first phase of the order, which is to assess each site for the potential presence of inactive hazardous waste sites and hazardous substances, and to recommend further action if required. Findings for the Bayou Choctaw, Big Hill, Bryan Mound, St. James, Sulphur Mines, Weeks Island, and West Hackberry SPR sites are contained in this report.

Recommendations for further sampling are made for the Bayou Choctaw, Big Hill, Bryan Mound, and Sulphur Mines sites. No further action is recommended at the St. James, Weeks Island, and West Hackberry sites. The following findings were made:

- Bayou Choctaw: Cavern 10 is believed to contain a caustic substance (corrosive hazardous waste). Allied Chemical stated that a potassium hydroxide solution was injected into the cavern. Sampling is recommended to confirm the type and amount of contamination in Cavern 10. Sampling of other unused Allied caverns is recommended with scheduled well entries to determine if they were also used for waste disposal by Allied Chemical. A chromium-containing drilling mud additive was used for brine disposal well 1. It is recommended that the stabilized mud disposal area be sampled for EP (extraction procedure) toxicity, to establish whether the drilling mud exhibits hazardous waste characteristics.

- Big Hill: Potentially contaminated brines have been identified in some of the wells. Preliminary qualitative analysis indicates some hazardous compounds are present. Additionally, chromium-containing drilling mud may have been used to drill some of the site wells. Quantitative sampling at the caverns for priority pollutants and sampling at the cuttings ponds for EP toxicity is therefore recommended.

- Bryan Mound: An investigation of the tarry areas, the Dow impoundment, and the municipal landfill is underway, in response to concerns raised by EPA. A chromium-containing additive was added to the drilling muds used on the Phase III caverns. Therefore, the stabilized mud pit should be sampled and analyzed for EP toxicity. Dow Chemical has stated that asbestos was disposed in caverns 4 and 5. These caverns should be sampled and analyzed to ascertain whether asbestos concentrations in the brine are similar to background levels observed in the Brazos River, as described by Dow.

- Sulphur Mines: A chromium-containing mud additive was used when drilling brine disposal wells 3 and 4. The mud pits were left in place and seeded. It is recommended that they be sampled for EP toxicity. Several radioactive tracer pellets from the gravel pack on brine disposal well 4 are unaccounted for and may remain in the mud pit. A background radiation scan for evidence of the possible presence of these pellets in the associated mud pit is recommended.

1. INTRODUCTION

1.1 BACKGROUND

In 1980, the United States Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). A provision of this act established liability for abandoned hazardous waste sites. On April 26, 1985, the U.S. Department of Energy (DOE) issued Order 5480.14, providing instructions for implementation of a DOE CERCLA program to identify, evaluate, and control hazardous waste disposal areas on its installations. This program consists of the following five phases.

1. Installation Assessment: Identification and location of suspected inactive hazardous waste sites on DOE facilities.

2. Confirmation: Performance of environmental surveys to verify the presence or absence of suspect inactive hazardous waste sites.

3. Engineering Assessment: Development of plans for remedial action at verified identified inactive hazardous waste sites which pose health, safety, or environmental threats.

4. Remedial Action: Implementation of the plans developed to control or remove hazardous substances from the sites.

5. Compliance and Verification: Verification and documentation that the remedial actions achieved CERCLA compliance.

Boeing Petroleum Services, Inc., (BPS) as the management, operations, and maintenance contractor for the SPR, has been tasked to gather data and survey the seven SPR sites. The findings are detailed in this Installation Assessment Report (IAR).

1.2 AUTHORITY

DOE Order 5480.14 requires the development of a Departmental CERCLA program to identify, evaluate and control inactive hazardous waste disposal sites on DOE installations. Phase I of this program is location and identification of inactive hazardous waste sites which pose a risk to health, safety, and the environment on DOE installations. DOE field elements are authorized to develop and implement a program to manage hazardous waste sites at their installations in accordance with the order. Status reports must be submitted to DOE upon completion of each of the various phases of the CERCLA program.

1.3 PURPOSE

The purpose of this IAR is to evaluate the history and records, and identify and locate evidence of any inactive hazardous waste disposal sites which might pose a risk to health, safety, or the environment as a result of migration of hazardous substances at the seven Strategic Petroleum Reserve sites; and to recommend follow-on action. Follow-on action includes sampling and analysis to confirm the presence or absence of suspect inactive waste sites identified by the installation assessment.

1.4 SCOPE

This report assesses the CERCLA status of all seven SPR sites, (Bayou Choctaw, Big Hill, Bryan Mound, St. James, Sulphur Mines, Weeks Island, and West Hackberry). The assessment is limited to DOE property; however, use of this property in regard to potential generation of hazardous waste prior to DOE acquisition (beginning in 1977) has also been researched and included. The first known industrial activities occurred during the early 1900s at Bryan Mound, the 1890s at Sulphur Mines and Weeks Island, and the 1930s at Bayou Choctaw and West Hackberry. Big Hill and St. James were primarily used for agricultural purposes prior to DOE acquisition.

1.5 METHODOLOGY

This IAR is based on a variety of data. Various SPR records, such as well histories, spill reports, permit applications, environmental monitoring data, accident reports, and non-compliance reports were reviewed. A survey to determine past owners and uses of the land was conducted. Site characterization reports, such as the programmatic and site specific Environmental Impact Statements and the Sandia National Laboratories Geological Site Characterization Reports were reviewed. All sites were visited for inspection, interview of selected personnel, and review of operating procedures. Interviews were also conducted with selected representatives of previous landowners.

This report then recommends that either no further action is required for a particular installation, or that specific further action is warranted at identified areas on individual installations. The installations where further investigation is necessary will then be addressed under the Confirmation phase.

2. INSTALLATION DESCRIPTIONS

2.1 ORGANIZATION AND MISSION SUMMARY

The Strategic Petroleum Reserve was mandated by Congress as part of the Energy Policy and Conservation Act of 1975. The purpose of the SPR is to reduce the possible impact of a disruption in the availability of imported oil, such as occurred with the Arab oil embargo of 1973-74. The original plan for the SPR was submitted in 1977, with construction and acquisition beginning later that year.

The SPR Plan, as amended, called for a one billion barrel oil supply. Three phases of development have been planned to create a 750 million barrel capacity. No decisions have been made concerning the final 250 million barrels of capacity required to produce a 1 billion barrel SPR.

Phase I, completed in 1980, consisted of acquisition and conversion of five existing sites and the construction of the St. James Terminal. The approximate capacity of the Phase I construction is 260 million barrels. Phase II called for the expansion of the West Hackberry, Bryan Mound, and Bayou Choctaw sites, to add an additional 290 million barrel capacity. Phase II construction began in 1980. The 200 million barrel capacity of Phase III construction would be accomplished by further expansion of Bayou Choctaw, Bryan Mound, and West Hackberry, and by the construction of a new facility at Big Hill. Phase III construction began in 1982. Both Phase II and Phase III construction continued until January 1, 1986, when budget reductions forced postponement of the work. These budget reductions call for the storage of 502 million barrels in the completed caverns. Recent release of funds has dictated restart of certain Phase III activities.

2.2 SITE DESCRIPTIONS

2.2.1 Bayou Choctaw

The Bayou Choctaw SPR site (Figures 2-1 and 2-2) is located in Iberville Parish, Louisiana, approximately twelve miles southwest of Baton Rouge, and four miles northwest of the town of Plaquemine. The site will contain six solution-mined storage caverns; four Phase I and one each of Phase II and III, with a total planned capacity of 66 million barrels. It is connected to the St. James Terminal via a 36-inch crude oil pipeline. A brine disposal area is located approximately 2.5 miles south of the main site, and consists of twelve wells on three wellpads. The main site occupies approximately 168 acres, while the brine disposal area occupies approximately 200 acres.

2.2.2 Big Hill

The Big Hill SPR site (Figures 2-3 and 2-4) is located in a remote area of Jefferson County, Texas, approximately 10 miles southeast of Winnie, Texas, and 23 miles southwest of Port Arthur, Texas. The site occupies approximately 275 acres. This Phase III site will have a capacity of 140 million barrels in 14 solution-mined caverns. The wells have been completed, but leaching has not yet started. Brine disposal will be in the Gulf of Mexico via a 48-inch pipeline. The site will be connected to the Sun Terminal in Nederland, Texas, via a 36-inch crude oil pipeline.

2.2.3 Bryan Mound

The Bryan Mound SPR site (Figures 2-5 and 2-6) is located about 2.3 miles southwest of Freeport, Texas, in Brazoria County. It occupies approximately 500 acres, and has a planned capacity of 226 million barrels in four Phase I, twelve Phase II, and four Phase III solution-mined caverns. Brine is disposed in the Gulf of Mexico via a 36-inch pipeline. The site is connected to the Phillips (formerly Seaway) dock in Freeport and to the Jones

Creek Tank Farm via two 30-inch crude oil pipelines. A 40-inch crude oil pipeline to Texas City, Texas, is in the planning stages.

2.2.4 St. James Terminal

The St. James Terminal (Figures 2-7 and 2-8) is located on the west side of the Mississippi River, approximately 2 miles north of St. James, in St. James Parish Louisiana, and directly across the river from Convent. The main site (tank farm) occupies approximately 105 acres, with another 48 acres for the two docks. There is no underground crude oil storage at St. James Terminal. In addition to the docks, the site consists of four 400,000-barrel tanks, two 200,000-barrel tanks, and associated pumping and metering systems. St. James Terminal is connected to the Bayou Choctaw and Weeks Island storage sites by two 36-inch crude oil pipelines. The terminal is also connected by pipeline to the adjacent Capline and LOCAP crude oil terminals.

2.2.5 Sulphur Mines

The Sulphur Mines SPR site (Figures 2-9 and 2-10) occupies approximately 175 acres in two adjacent areas in Calcasieu Parish, Louisiana, approximately two miles west of Sulphur. One area contains the pumping and control facilities, the other, the wellpads. The site consists of three Phase I solution-mined caverns, with a total capacity of 26 million barrels. Four brine disposal wells are located approximately one mile southwest of the site. The site is connected to the Sun Terminal at Nederland, Texas via a 16-inch crude oil pipeline which spurs from the 42-inch West Hackberry pipeline.

2.2.6 Weeks Island

Weeks Island's storage capacity consists of a converted room-and-pillar salt mine in Iberia Parish, Louisiana, approximately 2 miles northwest of Cypremort and 14 miles south of New Iberia.

The Morton Salt Company is still mining this dome at another level, separate from and below the oil storage area. The SPR Crude oil storage area consists of two interconnected levels, with a total capacity of 73 million barrels. This subsurface area is approximately 383 acres. The surface area (Figures 2-11 and 2-12) is approximately seven acres, located at several sites. The main site area contains the pumps, piping, meters, inert gas generators and a flare system. There is also a warehouse and laydown yard, fill area, firewater area, and two mineshafts.

2.2.7 West Hackberry

The West Hackberry SPR site (Figures 2-13 and 2-14) is located in Cameron Parish, Louisiana, approximately 18 miles southwest of Lake Charles. The total site area is approximately 565 acres. The site has a planned capacity of 219 million barrels in five Phase I, sixteen Phase II, and one Phase III solution-mined caverns. Brine disposal is either to the Gulf of Mexico or to ten brine disposal wells, located on two wellpads, approximately two miles south of the main site. The site is connected to the Sun Company Terminal at Nederland, Texas, via a 42-inch crude oil pipeline.

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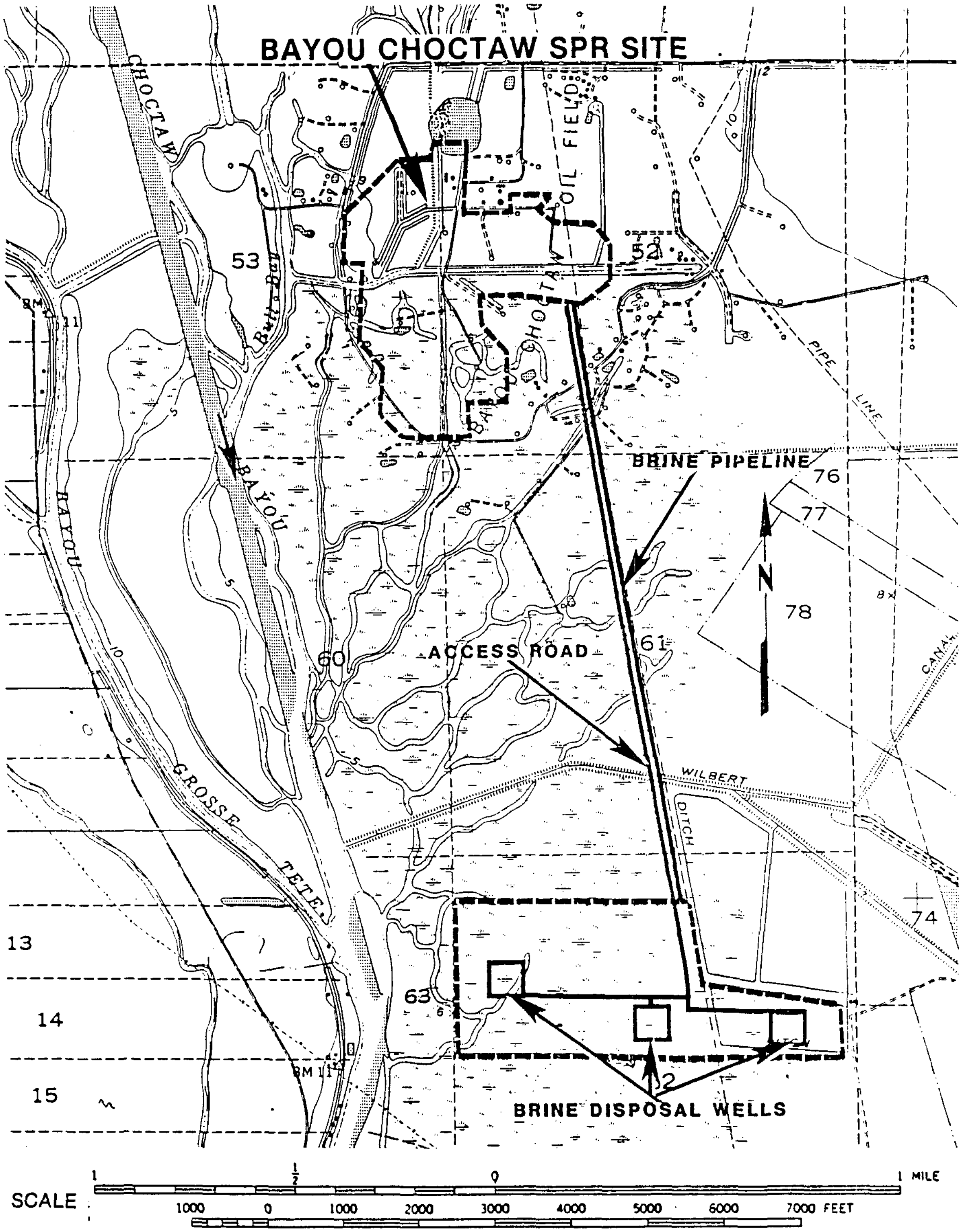


Figure 2-1. Bayou Choctaw Site Location
From U.S.G.S. 7.5 Minute Quadrangle Map for Addis, LA.

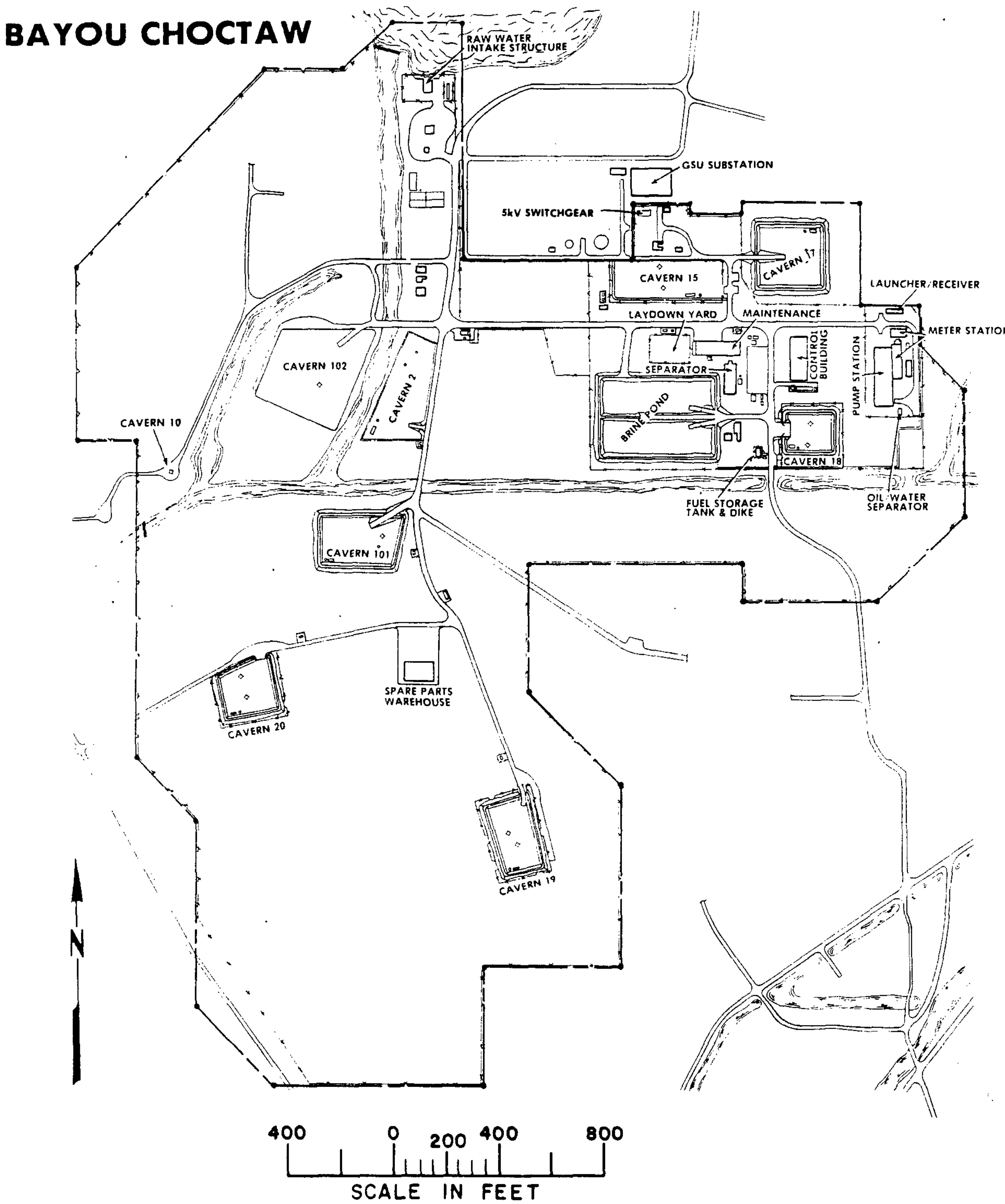


Figure 2-2. Bayou Choctaw Site Map

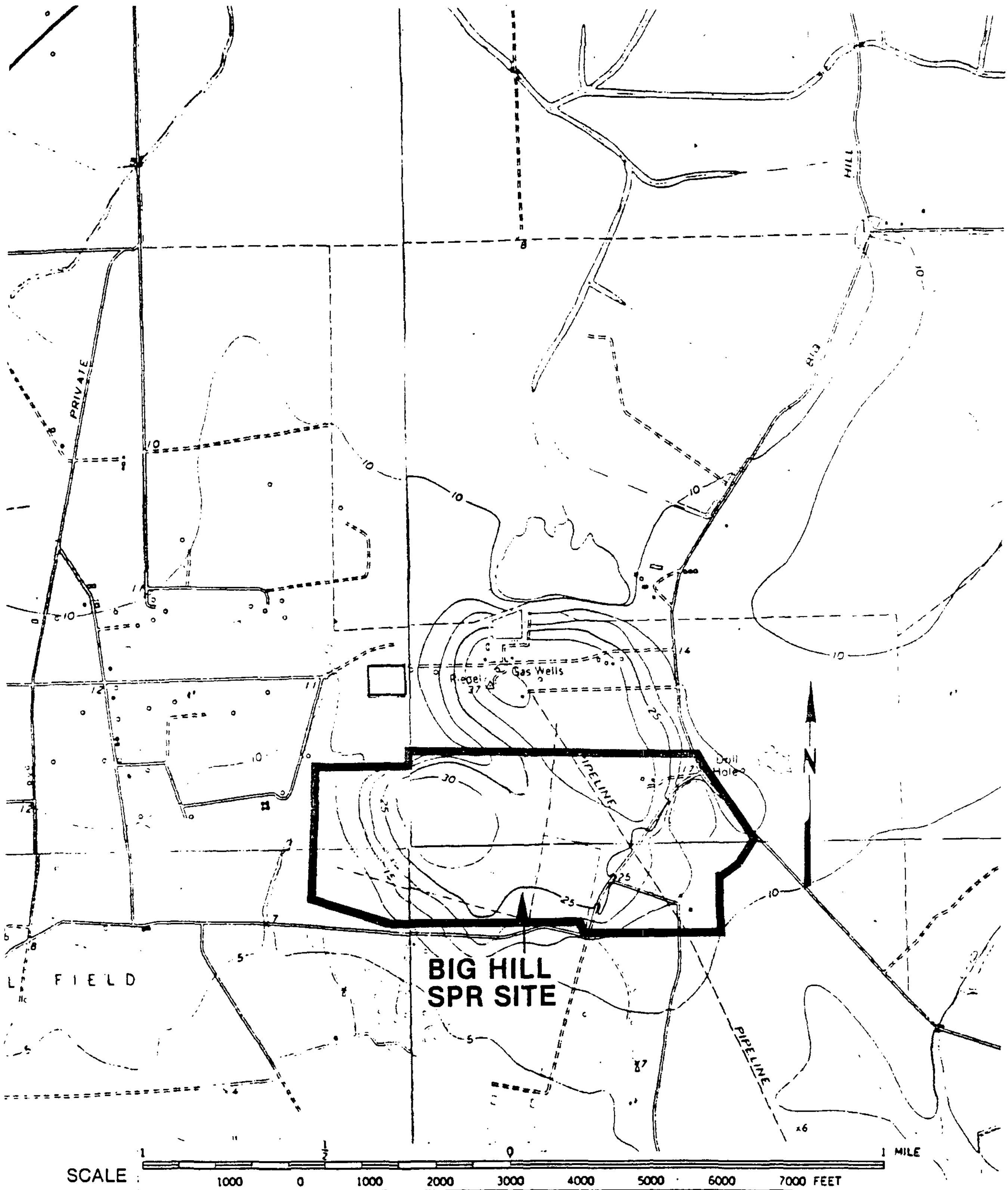


Figure 2-3. Big Hill Site Location
From U.S.G.S. 7.5 Minute Quadrangle Maps for Hamshire, Alligator Hole Marsh, Whites Ranch, and Star Lake, TX

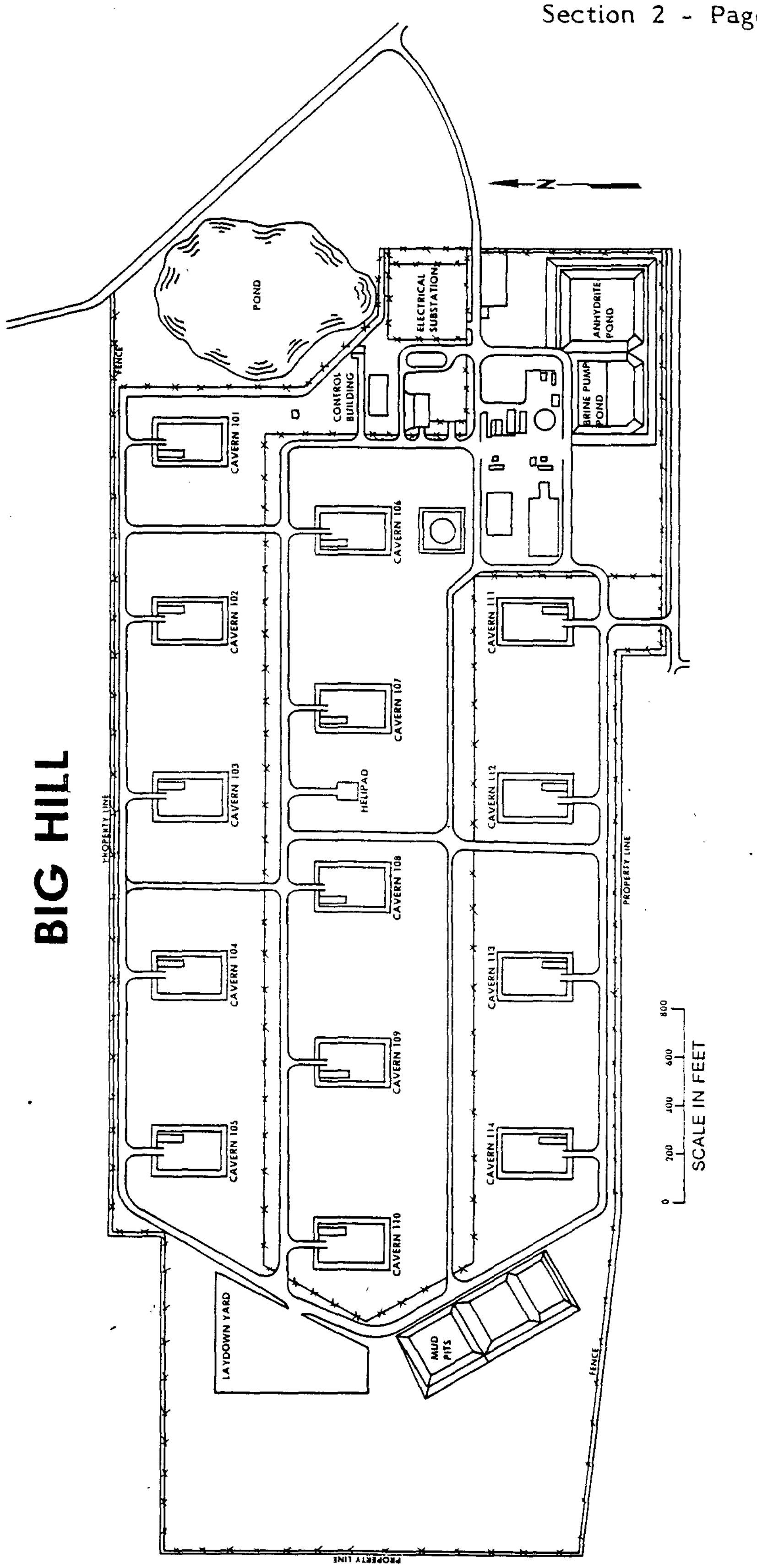


Figure 2-4. Big Hill Site Map

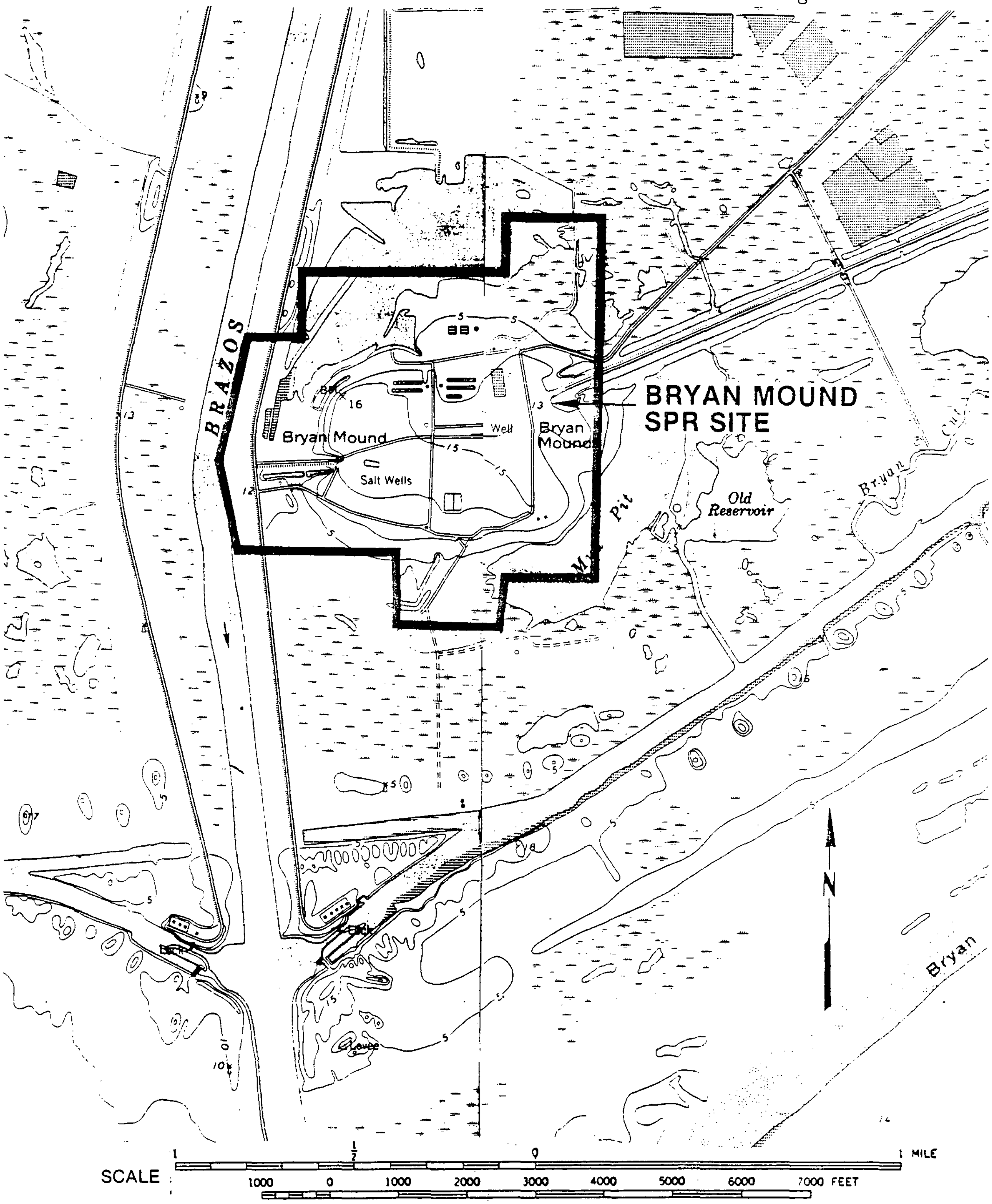


Figure 2-5. Bryan Mound Site Location
From U.S.G.S. 7.5 Minute Quadrangle Maps for
Jones Creek and Freeport, TX

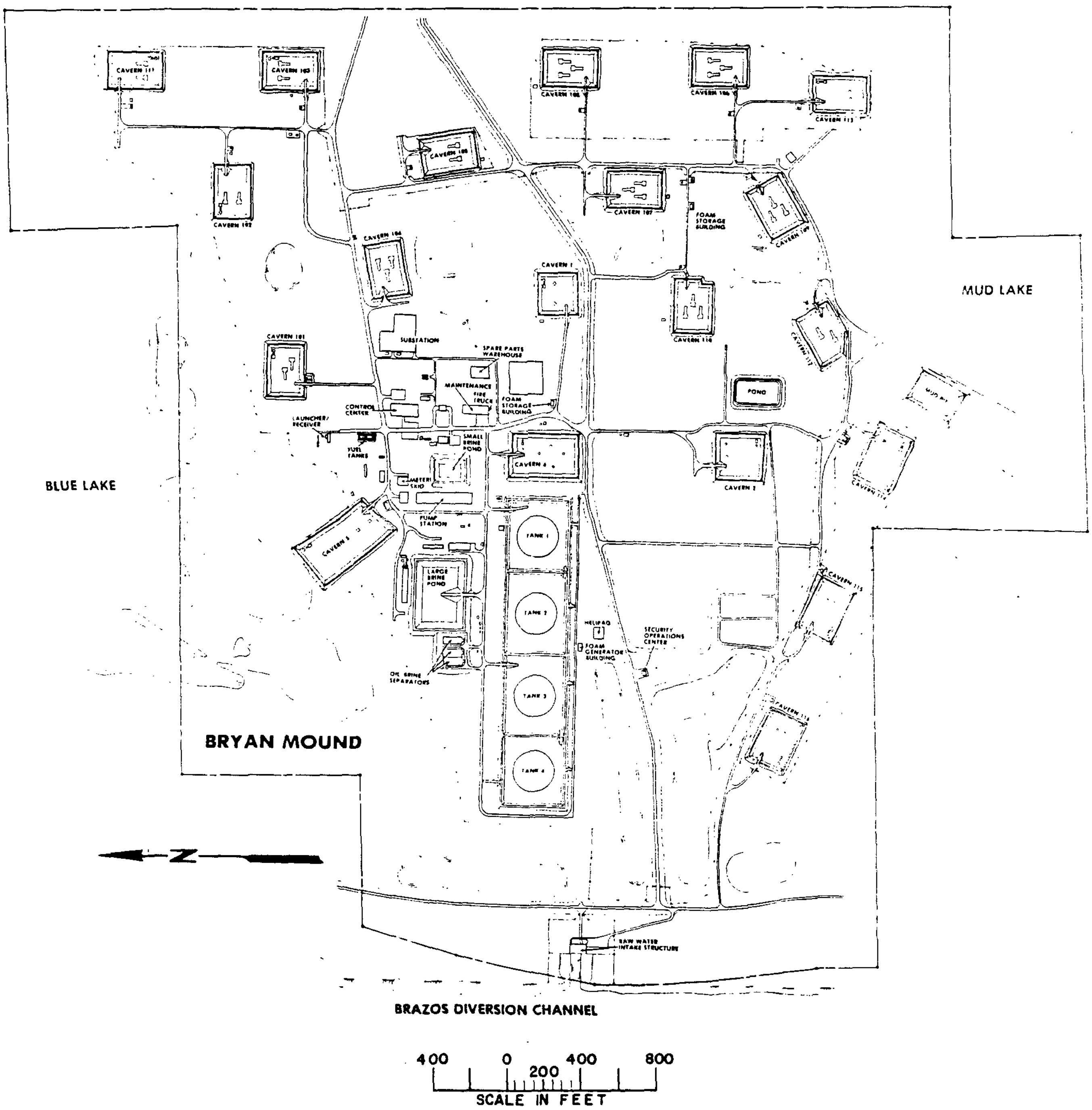


Figure 2-6. Bryan Mound Site Map

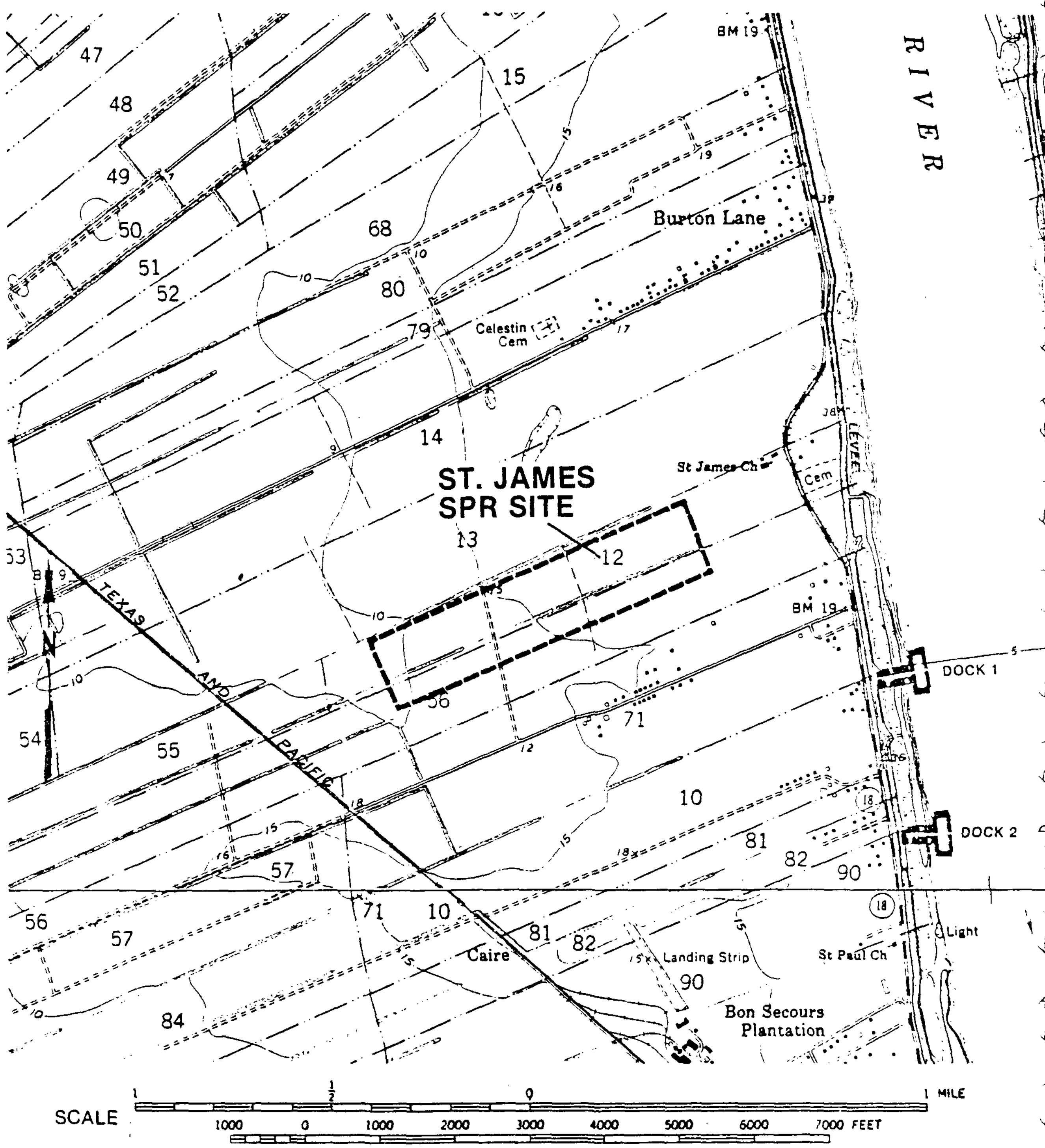


Figure 2-7. St. James Site Location
From U.S.G.S. 7.5 Minute Quadrangle Maps for
Convent and Lagan, LA

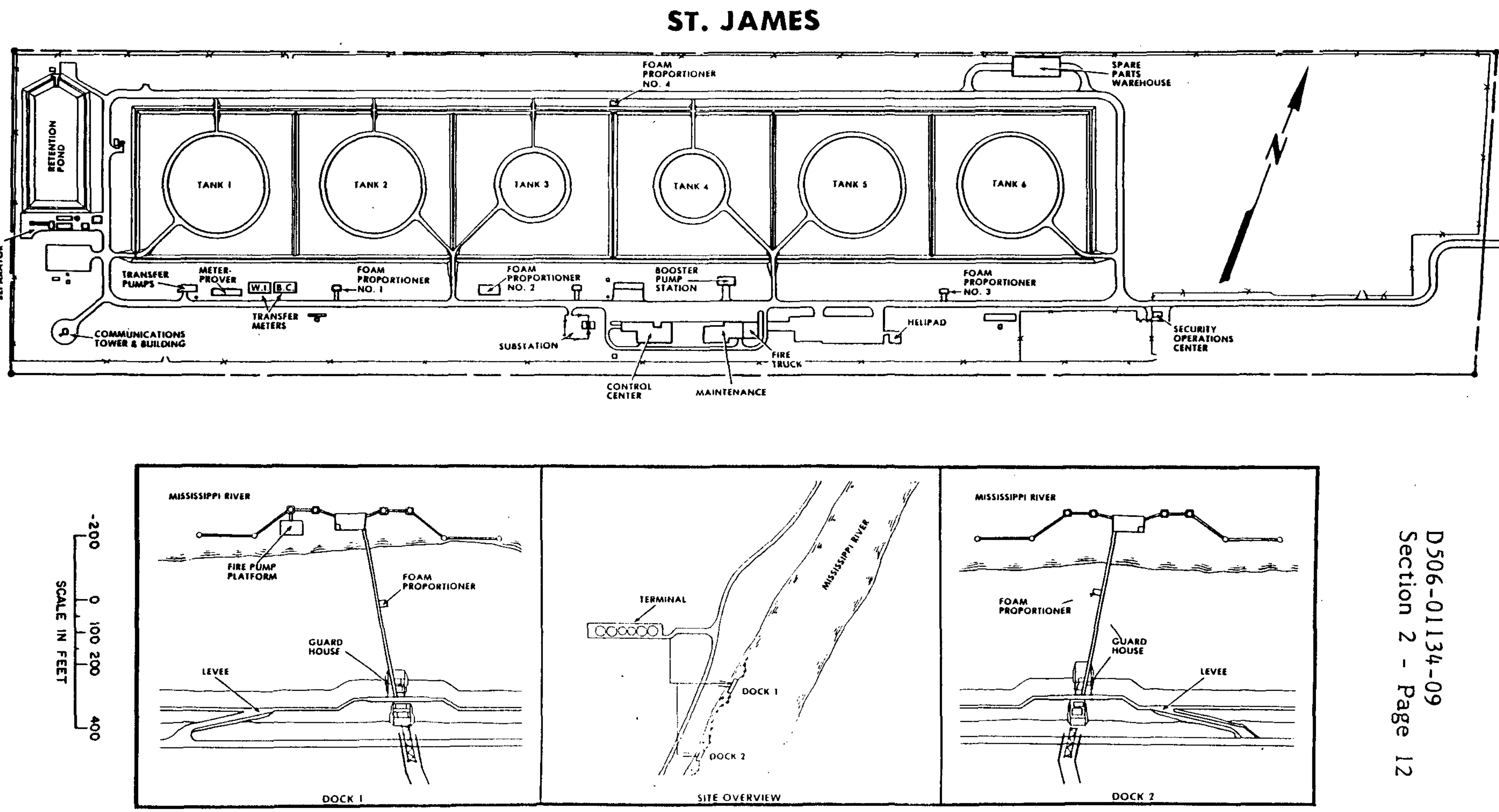


Figure 2-8. St. James Site Map

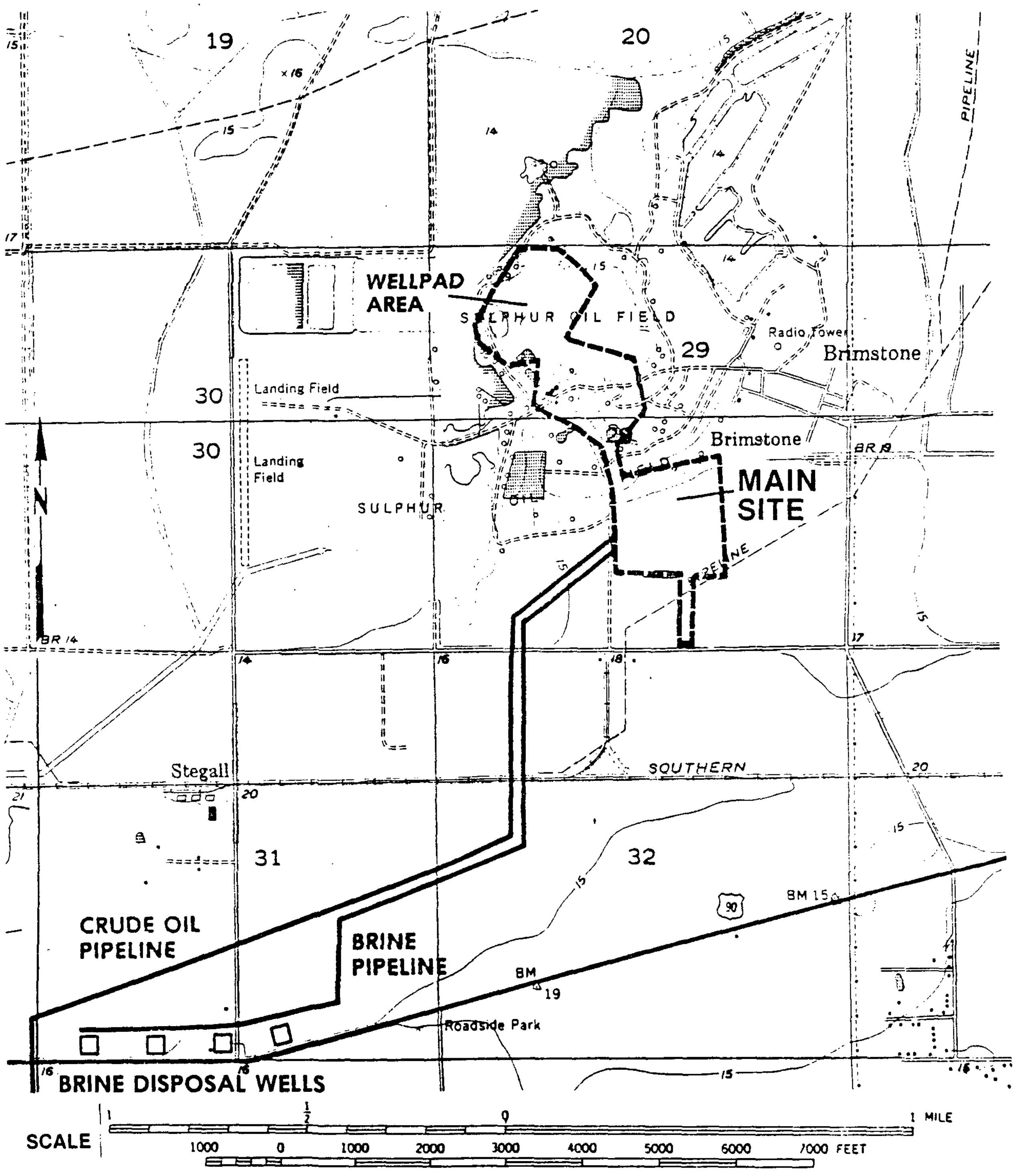


Figure 2-9. Sulphur Mines Site Location
From U.S.G.S. 7.5 Minute Quadrangle Maps for
Sulphur and Brimstone, LA

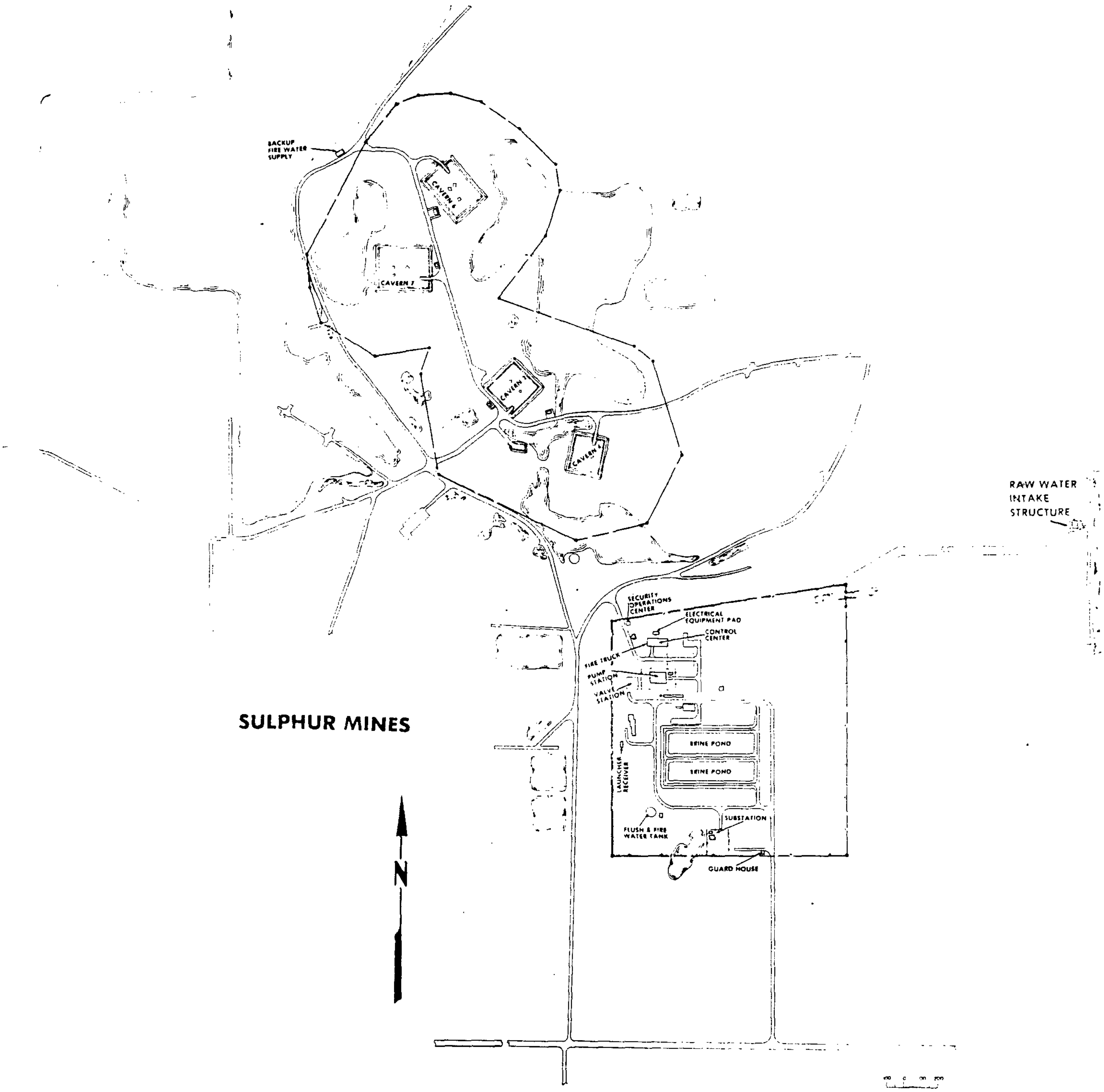


Figure 2-10. Sulphur Mines Site Map

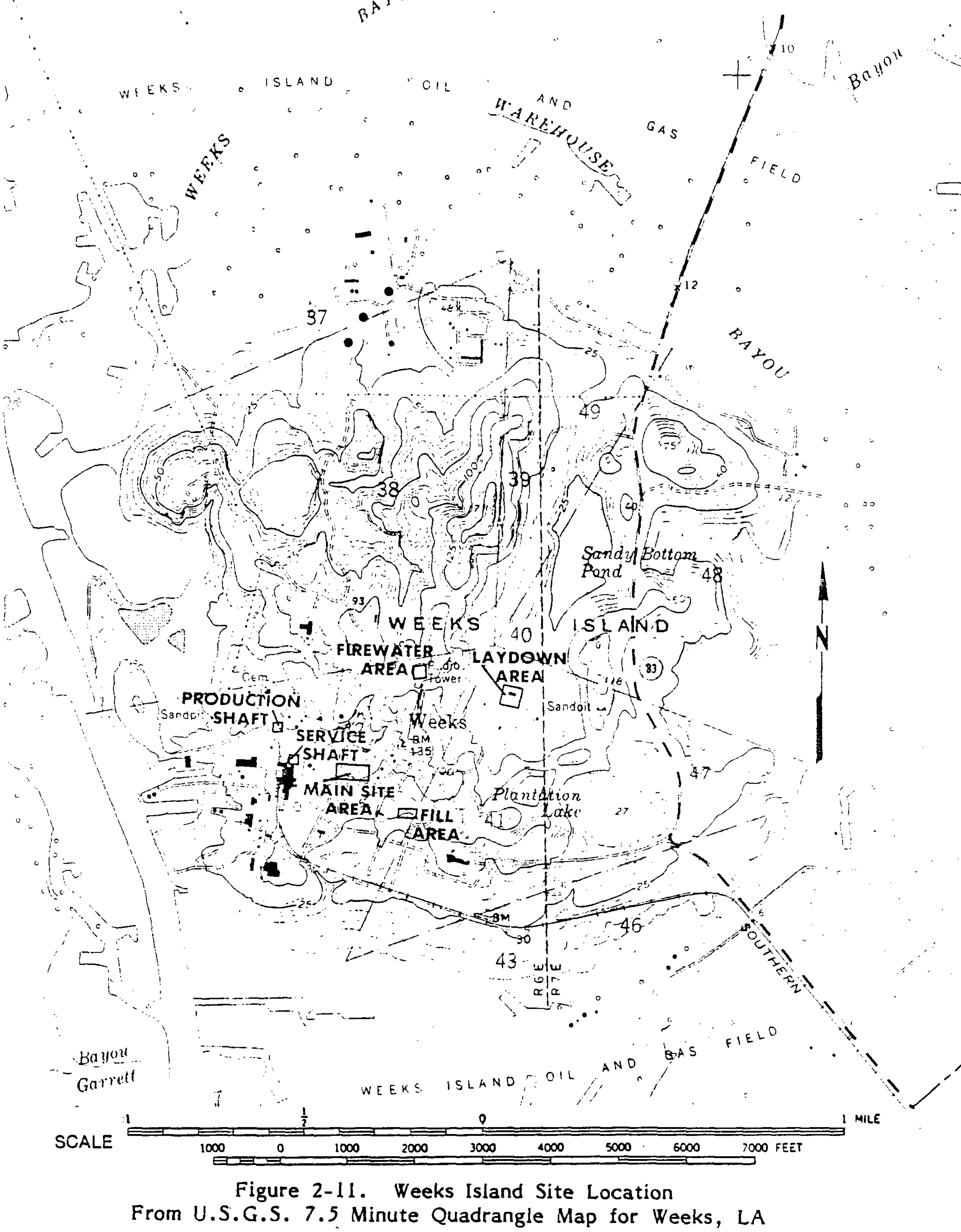


Figure 2-11. Weeks Island Site Location
From U.S.G.S. 7.5 Minute Quadrangle Map for Weeks, LA

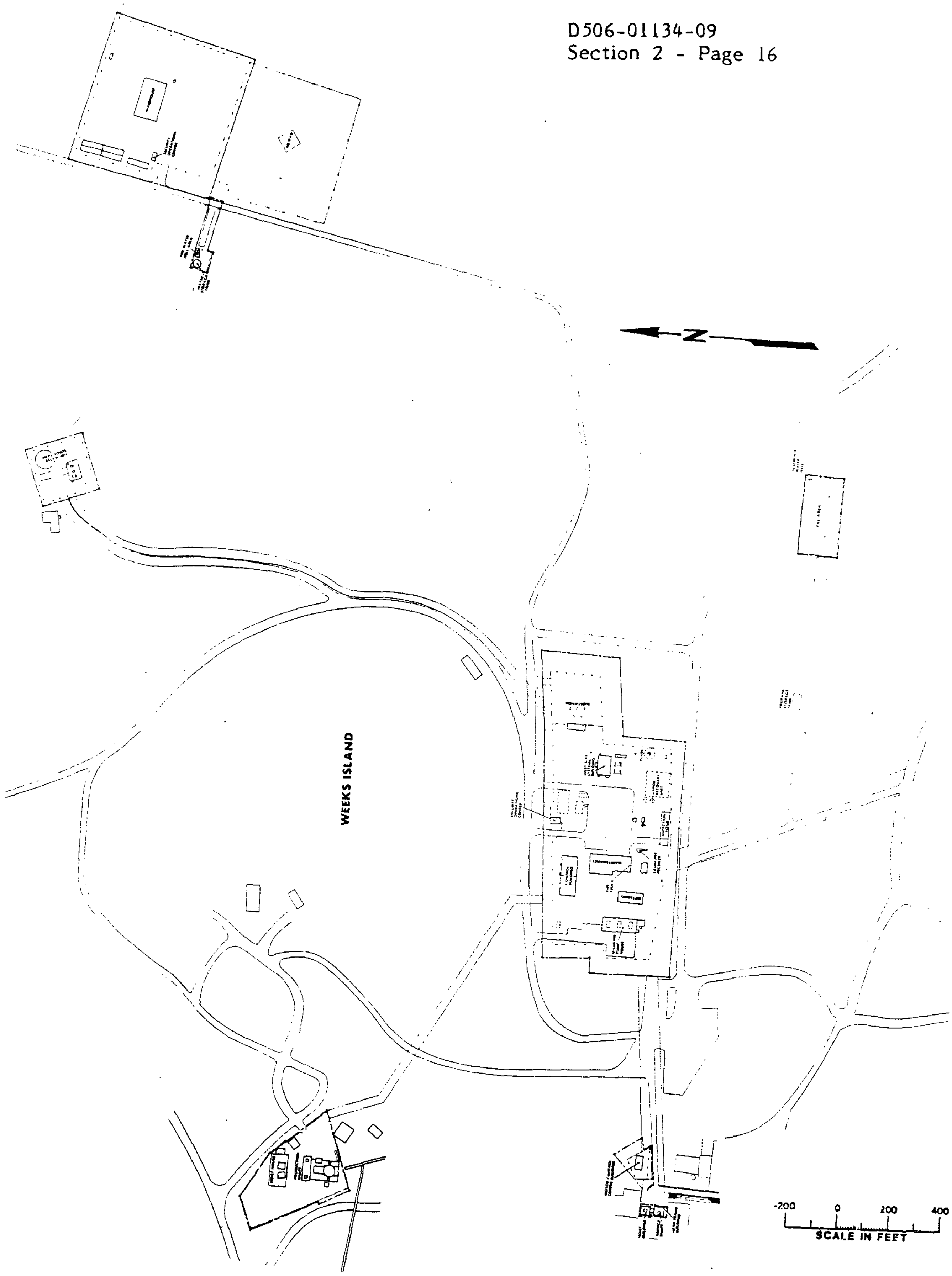


Figure 2-12. Weeks Island Site Map

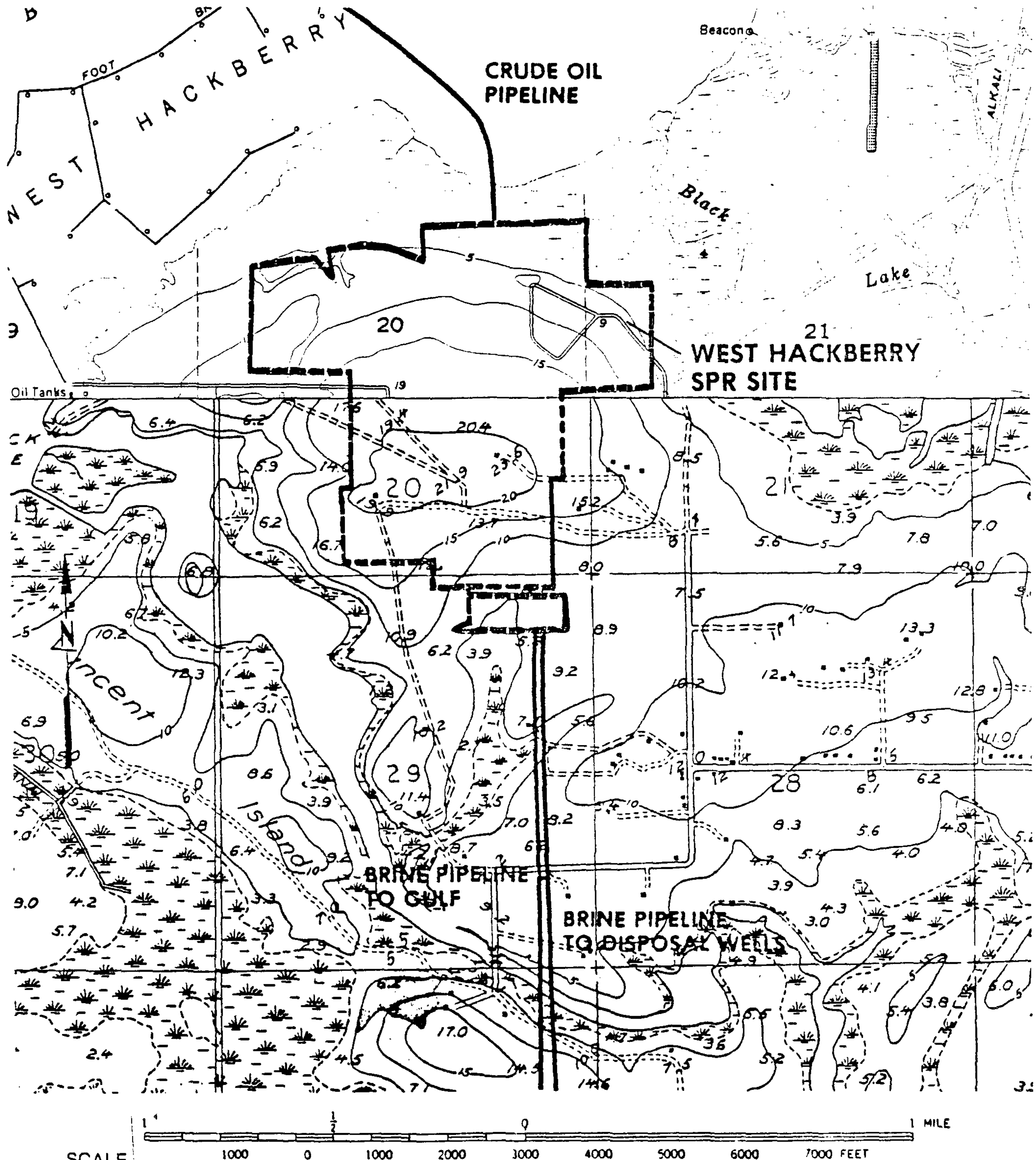


Figure 2-13. West Hackberry Site Location
From U.S.G.S. 7.5 Minute Quadrangle Maps for
Black Lake and Browns Lake, LA

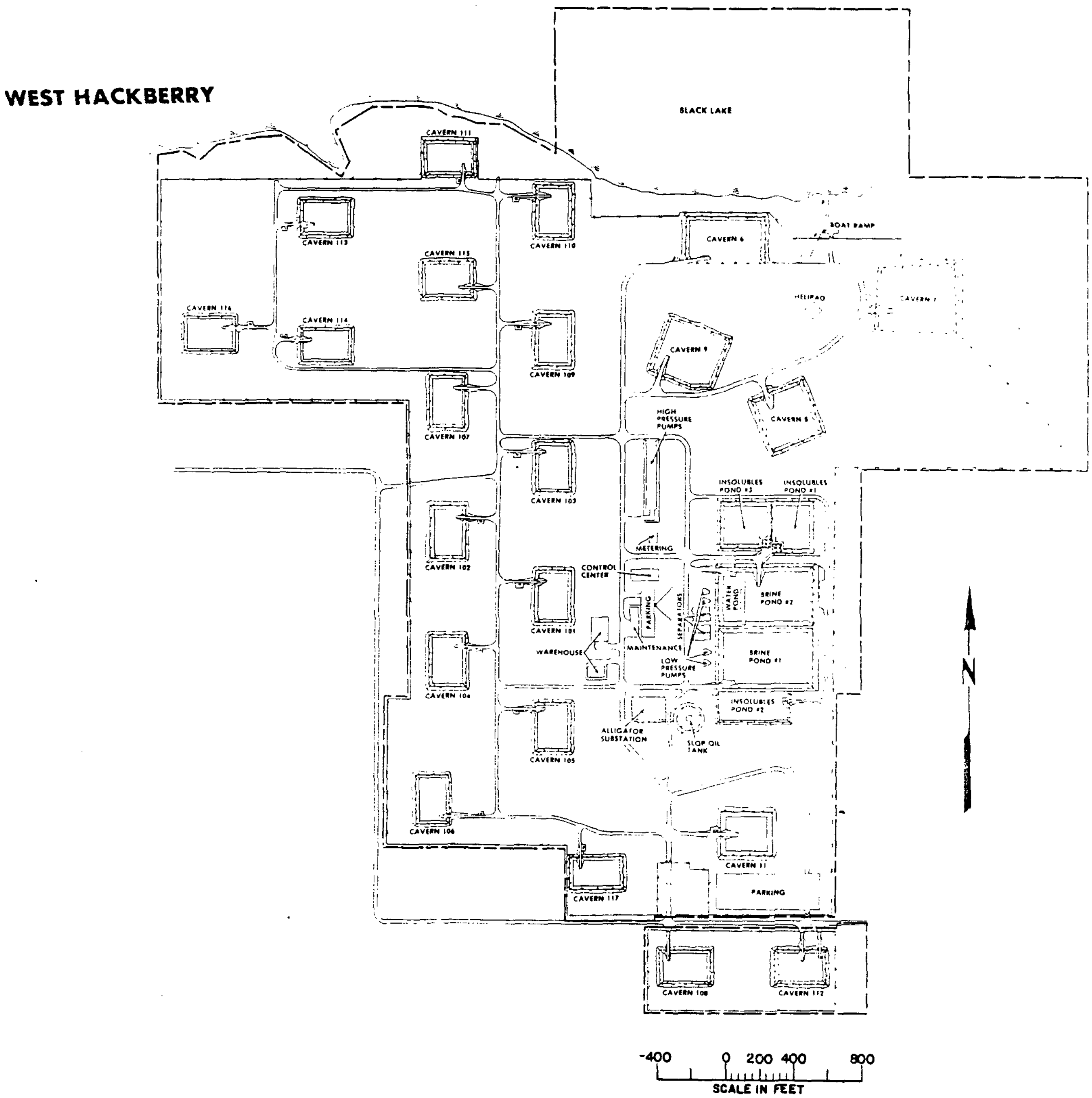


Figure 2-14. West Hackberry Site Map

3. ENVIRONMENTAL SUMMARY

3.1 ECOLOGY

The seven SPR sites are located within three ecological zones: the Texas Coastal Plain (Bryan Mound, Big Hill), the Chenier Plain (West Hackberry, Sulphur Mines), and the Deltaic Plain (Bayou Choctaw, Weeks Island and St. James). A number of ecosystems are found within these zones, most of which are common to more than one zone. Major ecosystems include: estuarine, coastal, and inland waters; beach and local island dunes (cheniers); cleared lands; fluvial and oak woodlands; deciduous swamps; gulf coast prairies; and gulf coast marshlands.

A large number of lakes, bays, and river mouths are found along the Gulf Coast. Specific areas near the sites are Mud Lake, Blue Lake, and the Brazos River at Bryan Mound; Calcasieu Lake, Brown Lake, and Black Lake at West Hackberry; and Weeks Bay, Vermilion Bay, and West Cote Blanche Bay at Weeks Island. A wide variety of species, ranging from plankton to fauna of commercial and sport importance, are found in coastal and estuarine areas. Redfish, sea trout, and flounder are among the more important fish, while shrimp, oysters, and the blue crab are the most important shellfish. Cameron, Louisiana, is the nation's leading port in the menhaden and shrimp fishery landings. Of particular environmental interest are filter-feeders, such as oysters, due to their sessile nature and ability to bioaccumulate pollutants. The southern bald eagle, an endangered species, may be found in estuarine areas.

Inland waters include rivers, streams, bayous, lakes, ponds, and wetlands. Man-made waterways include numerous canals and the Intracoastal Waterway. A wide range of salinities, from freshwater to saline, are represented. Bass, catfish, sunfish, and crappie are common sport species inhabiting inland waters. Catfish are indicative of broad benthic contamination, since they are bottom-feeders and likely to ingest more benthic pollutants than open-water feeders.

Wetlands, including swamps and marshlands, are highly important and environmentally sensitive areas. Saline, brackish, intermediate, and freshwater wetlands are found in the region. A number of endangered and rare species such as the peregrine falcon, the least tern, the reddish egret, and the brown pelican are found in this area. A number of species used in the fur industry such as the mink, nutria, muskrat, and raccoon are found in wetlands. Other mammals include rabbits, squirrels, fox, bobcat, and white-tailed deer, some of which are hunted for food and for sport. Migratory waterfowl are common, and several species of ducks and geese are hunted. Turtles, snakes, and alligator are the major reptilian species found. The flora tends to vary widely with salinity. Grasses predominate in the marshes; swamps also contain a variety of trees, such as bald cypress, black willow, water oak, and tupelo. The Sabine National Wildlife Refuge in Cameron Parish, Louisiana; the Brazoria and San Bernard National Wildlife Refuges in Brazoria County, Texas, and the McFaddin Marsh National Wildlife Refuge in Jefferson County, Texas, are located in wetland areas, in the vicinity of SPR sites.

Beaches and dunes are found in the Texas Coastal and Chenier Plain zones. These areas are mostly sand and shell with some salt-tolerant plants, such as saltwort and cordgrasses, present. A variety of mollusks, annelids, and crustaceans burrow in the sand. Snakes, rodents, turtles, and birds are also common. A number of sea turtles are on the endangered species list, and may be found in these areas and adjacent waters.

Coastal prairie is found in the Texas Coastal and Chenier Plain zones. Much of the prairie has been cleared for agricultural use. Prairie grasses are still found in some areas used for grazing and pastureland. Major food crops grown include rice and soybeans. A variety of domestic animals are found in the prairie and cleared areas. The primary domestic animal is beef cattle, and hogs are raised in some areas. Dogs are kept by many ranches. Wildlife include rodents, predators such as coyotes, and birds. Ducks and geese are frequently found in rice fields in the wintertime. A variety of reptiles is present.

Cleared agricultural land is also found in the Deltaic zone, primarily along the Mississippi River. Sugarcane, rice, soybeans and cotton are primary crops. Animals such as rabbits, squirrels, rodents, and birds are frequently found in this area.

Cleared land also includes urban, suburban, and industrial areas. Oil, gas, sulfur, and salt are produced in the area. Refining and processing operations are also present. Urban areas are generally found along major waterways.

Fluvial woodlands, found in much of the area, include oak, willow, gum, pecan, red maple, cottonwood, hickory, and sycamore. Swamp trees, such as bald cypress and tupelo are also present. Trapping is a commercially important activity and a variety of animals, such as rabbits, squirrels, and deer are hunted for food and sport. This ecosystem is a suitable habitat for the southern bald eagle. Snakes and frogs are common.

Oak woodlands contain loblolly pine, elm, hickory, and pecan, as well as a variety of oak trees. Animal species present are similar to those found in fluvial woodlands.

3.2 GEOLOGY

3.2.1 Salt Domes

The SPR sites are located in the Gulf Coast Geosyncline, which is characterized by a thick accumulation of sediments. In vertical section, the geologic formation of the area form a series of gently dipping truncated wedges that thicken coastward, causing each wedge to dip slightly steeper than the overlying wedge. The lithology reflects depositional environments including continental (alluvial plain), transitional (delta, lagoon, beach), and marine (continental shelf) formations.

Salt domes within the geosyncline occur in two belts. One belt extends through northern Mississippi, Louisiana, and Texas; the other extends along the Gulf Coast and offshore. The SPR sites are located in the southern belt. Salt domes result from upward plastic flow of deeply buried salt. This flow is initiated by the tremendous weight of the overlying sediments on the less-dense salt. Many salt domes exhibit a surface expression; however, they are usually minor structural features of the region.

The history of the Gulf Coast salt domes began with the deposition of the Louann salt, the so-called "mother salt." The Louann salt of the Gulf Coast region accumulated in portions of a post-Permian age geosyncline, which forms a crescent roughly 750 miles long following the northern perimeter of the present Gulf of Mexico. The southwestern end of the roughly 50,000-foot thick sedimentary accumulation which eventually filled this geosyncline is in northeastern Mexico, and the eastern end is near the Mississippi-Louisiana border.

The thickness of the salt varies and is estimated to be between 1,000 and 5,000 feet. Anhydrite beds are found throughout the Gulf Coast Geosyncline and are associated with the salt. Some areas of the Gulf Coast Geosyncline, such as the Sabine Uplift and the San Marcos Arch, are thought to be free of salt. It is believed that these areas represent either topographic highs during salt deposition or voids formed after salt deposition by lateral displacement due to the weight of overlying rocks.

3.2.2 Hydrogeology

The Chicot aquifer, the major fresh water aquifer in the region, was formed from Pleistocene age deposits. The Pleistocene units of the Louisiana Gulf Coast are, from oldest to youngest, the Williana, Bentley, Montgomery, and Prairie formations. In Texas, the Williana formation is called the Willis, the Bentley and Montgomery formations are combined into the Lissie, and the Prairie is called the Beaumont.

The Williana Formation is a gravelly sand at its base, fining upward to clay deposits. The basal Williana sand is interpreted to include the "C" or "700-foot" sand of the Chicot aquifer. The Bentley Formation is a gravelly sand at its base fining upward and grading to deltaic deposits. The base of the Bentley is interpreted to be the base of the "B" sand or "500-foot" sand of the Chicot aquifer. The base of the Montgomery is interpreted to be the base of the "A" or the "200-foot" sand of the Chicot aquifer. The depositional environment of the Montgomery was alluvial and deltaic. The Prairie Formation, comprised of alluvial, deltaic, bay and marsh, and littoral sediments, overlies these Chicot formations.

The most recent (Holocene) deposits consist of sands, silts, clays, and some gravels deposited by streams on alluvial and deltaic plains, and by wind and wave action along the shoreline of the Gulf of Mexico. Deposits are also accumulating as barrier islands and bars; in coastal lagoons, bays, and marshes; and as the alluvial floors of the valleys of modern streams.

3.3 METEOROLOGY

The general classification of the Gulf Coast climate is humid subtropical with a strong maritime influence. Prevailing winds are from the south much of the year. This movement of maritime air from the Gulf of Mexico tempers the extremes of summer heat, shortens the duration of winter cold spells, and provides a source of abundant moisture and rainfall.

Summer weather is consistently warm, but maximum temperatures rarely exceed 100°F, due to the moderating effects of cloudiness and scattered convective showers and thunderstorms. During the normally mild winters, the temperature rarely drops to freezing. The annual mean temperature over the region is about 70°F. In summer, the highest average daily maximums (°F) range from the upper 80s along the coast to the lower 90s inland. The lowest average daily minimums range from near 50°F along the coast to the middle 40s inland.

Relative humidity is generally quite high, with seasonal variations lowest in late winter and highest during the summer. Diurnally, the highest relative humidities are observed near sunrise and the lowest relative humidities are normally reached by mid-day or early afternoon.

There is a noticeable land and sea breeze effect predominantly during the spring, summer and fall seasons. During the daytime, a land breeze (southerly flow) is usually observed, and during the late evening and early morning hours, a sea breeze (northern flow) often occurs.

Precipitation is heavy and quite variable in the Gulf Coast area. The annual average rainfall for the sites varies from 45 to 64 inches. Thunderstorms over the sites occur approximately 60 to 70 days each year. Thunderstorm activity reaches a peak in July and August and a low from October through February. Measurable quantities of snow are rare.

Tornadoes, hurricanes, and tropical storms occur in the region. During the period 1955 through 1967, 22 tornadoes (1.7 mean annual frequency) were recorded within the one-degree latitude-longitude square that contains Baton Rouge. During the same period, 46 tornadoes (3.5 mean annual frequency) occurred within a similar one-degree square encompassing Freeport. The risk of hurricanes at each site is approximately 6 to 9% each year, while the risk of tropical storms is 13 to 23% each year. High winds and flooding frequently accompany these storms.

3.4 SITE SPECIFIC ENVIRONMENTAL SUMMARY

A summary of applicable environmental data for each individual SPR site is presented in this section.

3.4.1 Bayou Choctaw

3.4.1.1 Ecology

The habitat surrounding the site is a freshwater swamp. Elevations range from 5 to 10 feet above sea level. Although there are no clear topographic expressions in the area, major surface subsidence has occurred, creating substantial areas of bottomland hardwoods and swamp with interconnecting waterways. The site proper is normally dry and protected from spring flooding by flood control levees and pumps. The collapse of a solution-mined cavern in 1954 resulted in the formation of a 12-acre lake (Cavern Lake) on the north side of the site.

The site is located near the intersection of several major bayous and waterways. The Intracoastal Waterway (Port Allen Canal) passes in a north-south direction west of the site. North of the site the Port Allen Canal turns eastward, entering the Mississippi River at Baton Rouge. In the area of the site, the Intracoastal Waterway is part of Choctaw Bayou, a natural waterway.

Bayou Grosse Tete enters from the northwest and intersects the Intracoastal Waterway south of the site, with an interconnecting crossover almost due west of the site. Bayou Bourbeaux enters the area from the northeast and passes through Cavern Lake to form the North-South Canal through the site. The East-West Canal extends in a generally east-west direction on the southern side of the site, intersecting Bayou Bourbeaux, and continuing to Bull Bay and the Intracoastal Waterway. The Wilbert Canal flows east-west in an area north of the brine disposal wells, and joins the Intracoastal Waterway near its intersection with Bayou Grosse Tete.

Bottomland hardwood forest and deciduous swamps are predominant at the Bayou Choctaw site. Vegetation at the site includes bald cypress, sweet gum, tupelo (characteristic of lowland areas), bulltongue, and spike rush. Water oak is also present, but not abundant.

The deciduous swamp is the most widespread habitat type found at the site. It provides resources for a large number of wildlife. Bird species common at Bayou Choctaw include herons, American anhinga, egrets, woodpeckers, wood duck, thrushes, and American woodcock. Inhabitants of the bottomland forest and swamp include opossum, squirrels, nutria, mink, river otter, raccoon, swamp rabbit, white-tailed deer, snakes, and alligator. Land adjacent to the site has been leased for hunting purposes.

3.4.1.2 Geology and Soils

The Bayou Choctaw salt dome is located within the Gulf Coast Geosyncline, a region typified by large-scale, east-west trending normal (growth) faults and long term subsidence. The surface and near surface geology at Bayou Choctaw Consists of Pleistocene through Holocene sediments. These unconsolidated sediments thin from a thickness of approximately 1,000 feet away from the dome to about 400 feet over the top of the dome. These sediments include the undifferentiated sediments of the Williana-Bentley formation, which consist predominantly of sands and gravels with some clay layers. This unit, not present over the dome, thickens to 150 feet away from the dome.

A clay overlying the Williana-Bentley formation was identified in two wells at depths of 477 and 500 feet. The clay is 250 to

300 feet thick away from the dome. It is likely that the clay and gypsum caprock unit is composed of a considerable amount of this clay unit.

The Gonzales Sand, a thick sequence with clayey or silty layers, is approximately 130 feet thick over Cavern 2, thickening to 350 to 400 feet away from the dome. The Gonzales is a coarse to fine quartz sand predominantly, with occasional organic matter and shell fragments. The Prairie formation, overlying the Gonzales sand, is 40 to 60 feet thick over the dome, thickening to 80 feet away from the dome. The Prairie is at a depth of nearly 150 feet at the top of the caprock, descending to 200 feet away from the dome.

The Shallow Plaquemine formation is at a depth of 60 feet over the dome. Borings indicate that the Shallow Plaquemine is a coarse to medium, dense, gray, quartz sand with layers of silt and clay and occasional organic matter. This formation varies in thickness from 100 to 150 feet and is thinnest over the west flank of the dome.

The surface Atchafalaya Clay extends to the Shallow Plaquemine formation. Borings indicate that the unit is a predominantly soft gray clay with minor silt layers, pockets and layers of wood and other organic matter, and ferrous nodules near the surface. River flood waters left thin sand layers at the top of the unit.

3.4.1.3 Hydrology and Hydrogeology

In the vicinity of Baton Rouge, the Mississippi River changes from being erosional to depositional. Near Bayou Choctaw, the river is effluent to ground water during the spring high stage period, and influent during the fall low stage period. In the city of Baton Rouge, the principal aquifers are the "2,000" and "2,800" foot sands. The Baton Rouge fault is a significant hydraulic barrier to saline water migration from south of the fault into the industrial and potable water supplies of the city.

In the Bayou Choctaw area, the Plaquemine Aquifer, an alluvial deposit with a thickness of about 200 feet, is the principal aquifer. This aquifer is underlain by a series of saline clays and sands in the vicinity of the salt dome. The Holocene Atchafalaya Clay acts as an aquiclude to the Plaquemine Aquifer. The Plaquemine Aquifer is composed of two units, the Shallow Plaquemine and a lower unit equivalent to the Gonzales Sand, separated by the Prairie Clay. The Prairie Clay is laterally discontinuous, allowing communication between the the Shallow Plaquemine and Gonzales units. The Mississippi River, in direct hydraulic connection with the Plaquemine Aquifer, affects the hydraulic head within the aquifer. At the Bayou Choctaw site, the piezometric head in the aquifer rises to +15 feet during the high river stage, with flow towards the Atchafalaya, and drops to +5 feet during low river stage, with flow towards the Mississippi.

Data from numerous wells extending into the Plaquemine Aquifer in the Iberville Parish indicate a coefficient of permeability ranging from 1,900 to 2,500 gpd/ft^2 (gallons per day per square foot). The elevation of the fresh water/saline interface around the dome is at approximately 400 feet. The different chemical compositions observed in the two groups indicate a general lack of mixing of the two types of water.

3.4.1.4 Air and Water Quality

A study of air quality was made from September, 1982 to October, 1983. Parameters measured included non-methane hydrocarbons (NMHC), total suspended particulates (TSP), and ozone.

The monthly geometric mean for TSP varied from 26.1 ug/m^3 (micrograms per cubic meter) in February to 67.0 ug/m^3 in May, with an average of 45.5 ug/m^3. The highest value recorded was 148.1 ug/m^3. The primary standards are a 75 ug/m^3 annual geometric mean and a 260 ug/m^3 24-hour maximum. The highest hourly ozone value recorded was 0.212 ppm (parts per million). Monthly averages of the daily highest values ranged from 0.032 ppm during February to 0.086 ppm during August. The primary standard is 0.12 ppm hourly. The monthly average of the maximum hourly concentration of NMHC varied from 1.63 ppm in April to 6.21 ppm in January. The primary standard is 0.24 ppm in a 3-hour average.

Surface water quality has been monitored at the site since 1982. Parameters measured include pH, salinity, specific conductance, temperature, dissolved oxygen (DO), total suspended solids (TSS), oil and grease, total organic carbon (TOC), and biochemical oxygen demand (BOD). The pH of the waters around the site is usually slightly basic, ranging between 7.0 and 8.0 with occasional excursions. Extremes range from 6.6 to 8.8. Salinity is usually zero, with few excursions. The highest salinity value recorded was 9 ppt (parts per thousand). The station at the East-West Canal and the brine disposal well road is most frequently non-zero.

The TSS of Bayou Choctaw waters is generally high, in the 25 to 40 mg/l (milligrams per liter) range. This level is thought to be indigenous to the waters, rather than due to discharges from the site. TSS non-compliances of site discharges occur rarely, with no observed effect to the TSS of the surrounding waters. Control stations exhibit TSS levels consistent with fluctuations observed at other site monitoring stations.

The DO is usually above 5 mg/l. It is not thought that excursions below this are due to organic loading, since the BOD is consistently low, exceeding 10 mg/l on only one occasion. The TOC usually correlates quite well with BOD. Oil and grease was not detected during 1982 through 1984. In 1985, oil and grease was found at levels of up to 11.8 mg/l at all four stations during January, and at a level of 10.7 mg/l at one station in May. This is attributed to activities of upstream industries, as supported by control station data.

Two ground water monitoring stations are at Bayou Choctaw, located north and northwest of the brine ponds. The wells were sampled during 1984 and analyzed for pH and salinity. The pH was slightly acidic, ranging from 6.4 to 6.7 for the north well and 6.0 to 6.5 for the northwest well. Salinity ranged from 9 to 23 ppt in the north well and 11 to 40 ppt in the northwest well. The unavailability of well log and installation data precludes meaningful interpretation of the ground water data.

3.4.2 Big Hill

3.4.2.1 Ecology

The Big Hill facility is located in a rural area of Jefferson County, Texas, approximately 68 miles east of Houston, 23 miles southwest of Port Arthur, and nine miles north of the Gulf of Mexico. Only small unincorporated communities are located in the proximity of the site. The economy is dominated by rice farming, cattle grazing, and oil and gas production. The agricultural and pastureland uses around Big Hill are typical of the region. Existing habitats in the vicinity of the complex are related to agricultural use. Petroleum-related industrial operations on and off the salt dome have caused minimal impact to existing habitats.

No wetlands exist within the immediate vicinity of the site. However, less than a mile south of the dome is the northern boundary of fresh to intermediate marsh, which grades into brackish and saline marsh towards the Gulf of Mexico. The nearby waterways include Spindletop Ditch, approximately three miles south of the site, which connects to the Intracoastal Waterway two miles further south. General freshwater impoundments are located south of the site. There are two ponds, one on and one adjacent to DOE property. Numerous sloughs, bayous, and lakes, including Willow Slough Marsh, Salt Bayou, Star Lake, and Clam Lake connect with the Intracoastal Waterway. There is a remnant chenier paralleling the coastline, which at present isolates the marsh from the Gulf of Mexico.

The upland habitat, which comprises the majority of the site, consists of many tall grasses such as bluestem, indian grass, switchgrass, and prairie wildgrass. Fauna typical in the area include rabbits, raccoon, rodents, snakes, turtles, and numerous upland game birds. The adjacent grasslands, which have been cultivated for rice crops, are popular feeding grounds for wintering waterfowl. The nearby ponds and marsh south of the site provide excellent alligator habitat.

3.4.2.2 Geology and Soils

The soil profile at Big Hill consists of a surface layer 1 to 3 feet thick, composed of silt and fine sand, underlain by medium stiff to stiff clays of varying composition. The clays are interbedded with silty fine sand. Locally, a silty sand layer less than 5 feet thick exists at depths of 8 to 10 feet below the surface.

The major surface soil groups present at Big Hill include the Hockley, Crowley, and the Morey silt loams. All are modifications of Beaumont Clay.

The Hockley silt loam is typically observed over salt domes having a topographic expression. This soil covers most of the hill and is 14 to 30 inches thick. The Crowley silt loam is present on the east side of the site. The upper 12 inches is granular, but the subsoil is very compact. The surface Morey silt loam can hold a moderate amount of moisture for plant use, but common surface crusts and impermeable subsoil make it difficult for water to enter the soil. The unmodified Beaumont marine clay is present in the extreme southwest and northeast corners of Big Hill.

Results of consolidation tests indicate that clays are generally overconsolidated and of low compressibility. The natural moisture contents of all soils are lower than the liquid limits. Swelling clays are common in the Beaumont clay and associated soils. Soils that may swell are those subject to seasonal moisture change and that have an overburden pressure less than the swelling pressure of the soil.

3.4.2.3 Hydrology and Hydrogeology

There are two brine ponds on the Union Oil Company property adjacent to the SPR's Big Hill site, one with a capacity of 41 acre-feet, the other 49 acre-feet. Two freshwater ponds are located on top of the dome. A 50-acre pond, on the north side of the dome, has been modified somewhat for rice field irrigation. A second pond, located on the southeast corner of the dome, covers 20 acres. It appears to have been built up on the south side. The freshwater ponds do not seem to be related to subsidence. Surface drainage is good, and erosion is negligible because of permanent ground cover.

The subsurface hydrologic units of the Big Hill area are the Chicot and Evangeline Aquifers and the Burkeville Aquiclude. The Burkeville Aquiclude is the lowermost hydrologic unit and corresponds to the Miocene Logarto Clay. The Evangeline Aquifer overlies the Burkeville Aquiclude, and includes the lower Pliocene Goliad Sand, and the silts and sands of the upper Pliocene. The Evangeline Aquifer, 1000 to 1,100 feet thick, contains saline water near the dome. The Chicot Aquifer overlies the Evangeline Aquifer and includes the Beaumont Clay. The Chicot is divided into two units with fresh water in the upper unit, grading to saline water with depth. This aquifer is 1250 to 1350 feet thick and is more permeable than the Evangeline aquifer.

The ground water surface varies from a depth of 6 feet below the surface near the center of the dome (elevation +37 feet mean sea level (msl)) to about ground level near the base of Big Hill (+10 feet msl). The ground water level generally follows the topography of the site.

Fresh water (<1000 mg/l dissolved solids) is limited to the Upper Chicot in the Big Hill area and to a zone extending from near the surface to a depth of slightly less than -100 ft msl over the dome. Slightly saline (1000 to 3000 mg/l dissolved solids) water is present below the fresh water to -300 ft msl over the dome, and to -500 ft msl near Winnie.

The withdrawal of water from the lower Chicot in the Beaumont/ Port Arthur area affects water levels at Big Hill and produces a movement of ground water in an east-southeasterly direction from Big Hill. The withdrawal of water from the upper Chicot at Winnie creates a cone of depression, drawing the saline/fresh-water interface in the Upper Chicot toward Winnie and reducing the aquifer pressure, potentially leading to minor regional subsidence. From 1951 to 1965, the water level declined several feet at Big Hill.

3.4.2.4 Air and Water Quality

There has been no monitoring of air, surface, water and ground water quality at Big Hill. Water and air quality monitoring programs will be established in the future.

3.4.3 Bryan Mound

3.4.3.1 Ecology

The area around the Bryan Mound site is highly industrialized, with petroleum related facilities predominant. The site is in the southwest apex of a triangle formed by the Brazos River Diversion Channel, the old Brazos River, and the Intracoastal Waterway. A U.S. Army Corps of Engineers silt gate controls the flow of water between the Intracoastal Waterway and the Diversion Channel. The levees protecting the town of Freeport, to the northeast, form a second triangular pattern within the triangle formed by the rivers. A levee parallels the Diversion Channel to the west of the site. A second levee north of and parallel to the Intracoastal Waterway essentially bisects the site, beginning at the Division Channel levee and proceeding northeast.

The major nearby water bodies are Blue Lake, north of the site, and Mud Lake to the southeast. These water bodies generally define the mounded aspect of the dome upon which Bryan Mound is located. Blue Lake is within the 3.4-square-mile protective triangle formed by the levee system. Although excess rain water is removed from the levee area by two large pump stations operated by the city of Freeport, there is some drainage southward through culverts into the Intracoastal Waterway. Mud Lake is directly connected with the Intracoastal Waterway.

The marsh and prairie areas surrounding Bryan Mound, are typical of the Texas Gulf Coast region. Brackish marshland dominates all low-lying site areas, with the exception of the northern area, where the coastal prairie ecosystem extends along the levees paralleling the Brazos River Diversion Channel. The coastal prairie ecosystem is characterized by medium to very tall grasses, which form a moderate to dense cover for wildlife. These grasses are usually found in the site area where soil moisture extends to a great depth. Those areas periodically inundated by seawater are dominated by marsh-hay cordgrass.

A diverse range of habitats is created by the water bodies surrounding Bryan Mound. Marshes and tidal pools, such as Mud Lake and Bryan Lake, which connect with the Gulf of Mexico by way of the Intracoastal Waterway or the Brazos River, are ideal habitats for a variety of birds, aquatic life, and mammals. Typical fauna in the Bryan Mound area include the common egret, snowy egret, migratory waterfowl, great blue heron, killdeer, nutria, raccoon, skunk, rattlesnakes, turtles, and frogs. The least tern and black-necked stilt, state-protected species, are also found on the site.

Shrimp, crab, trout, flounder, and redfish are found in Mud Lake during various seasons of the year. Black drum, mullet, gar, and blue crab are found in Blue Lake.

3.4.3.2 Geology and Soils

Physiographically, Bryan Mound lies within the Gulf Coastal Plain Province, which is characterized by relatively low, flat terrain where marshes, swamps, and meandering streams are common. The region's major topographic relief is associated with salt dome structures, such as Bryan Mound, which have elevated the surface sediments. Old maps indicate that at one time a relief of 24 feet or more may have been present over the dome. This suggests that reworking of the surface during sulfur and brine operations, and subsidence due to sulfur mining may have lowered the overall relief of Bryan Mound to its current high point of 19.5 feet.

Above the salt dome and to a depth of approximately 350 feet, there is a sequence of sands, silts and clays with minor amounts of gravel. This unit is underlain by shales with sands, which become progressively more sandy with depth. A shale layer of more or less constant thickness directly overlies the caprock at all of the wells.

The surface sediments are classified as Quaternary alluvium surrounding Bryan Mound and as Beaumont Formation over the dome. Quaternary alluvium in the vicinity of Bryan Mound is characterized by clay, silt, sand, and gravel with abundant organic matter. These unconsolidated sediments have been reworked with the Beaumont Formation by wind, wave, and fluvial action into the parent material for the local Surfside-Velasco soil. This soil is clayey, very poorly drained, and very slowly permeable. Due to past activities, much of the surface material at Bryan Mound is industrial rather than natural in origin. Four strata may be characterized as:

Stratum 1	Firm to stiff, gray and brown silty clay with layers of fine sand and sandy silt to 12 feet.
Stratum 2	Stiff to very stiff, blue gray to gray clayey silt with silty sand, sandy silt and silty clay layers to 25 feet.
Stratum 3	Firm to stiff, gray silty clay and clay with organic material, silt pockets, and sandy clay layers to 45 feet underlain by dense silty sand to 55 feet.
Stratum 4	Stiff to very stiff, blue gray clayey silt and silty clay, with occasional silt and sand lenses, becoming more dense with depth to 154 feet.

3.4.3.3 Hydrology and Hydrogeology

The Bryan Mound salt dome is situated at the edge of the Gulf Coastal Plain, approximately two miles from the Gulf of Mexico. The mound itself is virtually surrounded by water, as discussed in Section 3.4.3.1.

Drainage off the mound is divided by the Hurricane Protection Levee, which uses Bryan Mound as its southwestern corner. Water draining from the mound collects in either Blue Lake to the north or Mud Lake to the southeast. Blue Lake is inside the Hurricane Protection levee, and is thus virtually shut off from any outside circulation or tidal influence. Mud Lake has access to the Intracoastal Waterway, and therefore to the tidal fluctuations of the Gulf of Mexico. The isolation of Blue Lake is emphasized by its clarity relative to Mud Lake.

Water which drains outside of the Hurricane Protection Project levee flows into a more dynamic estuarine system. The Brazos River Diversion Channel, immediately west of the mound, flows directly into the Gulf of Mexico a few miles south of the site. The quality of water in the Diversion Channel varies greatly due to constant changes in river stage, tide, upstream agricultural practices, and industrial and municipal discharges.

The Chicot and Evangeline aquifers are the only hydrological units bearing fresh or slightly saline water in Brazoria County. The Evangeline aquifer consists of alternating sands and clays ranging from about 2,000 feet thick inland to more than 3,500 feet thick at the coast, with an average permeability of about 250 gpd/ft^2.

The upper unit of the Chicot is the most widespread fresh water aquifer in Brazoria County, and the only source of fresh water in much of the coastal area. This unit varies from less than 50 to 100 feet in thickness in much of Brazoria County. The lower slightly saline unit of the Chicot, separated from the upper unit by clay, includes 100 to 300 feet of water-bearing sands. Permeability of the Chicot aquifer ranges from 130 to 1,655 gpd/ft^2. The physicochemical quality of the water is affected by the interconnection of aquifers and the proximity to salt domes.

The fresh water potential of the Freeport area is considered overdeveloped. A large cone of depression occurs in the water level surface due to pumping from the upper unit of the Chicot. Subsidence of as much as 1.6 feet between 1943 and 1979 is attributed to local pumping.

3.4.3.4 Air and Water Quality

A study of air quality was made from September, 1982 to October, 1983. Parameters measured included NMHC, TSP, and ozone.

The monthly geometric mean value for TSP varied from 32.9 ug/m^3 in January to 133.2 ug/m^3 in July, with an overall average of 55.2 ug/m^3. The highest value recorded was 239.7 ug/m^3. The primary standards are a 75 ug/m^3 yearly average and a 260 ug/m^3 24-hour maximum. The highest hourly ozone value recorded was 0.151 ppm. Monthly averages of the highest daily values ranged from 0.037 ppm for December, to 0.076 ppm in May. The primary standard is 0.12 ppm hourly. The monthly average of the maximum hourly concentration of NMHC varied from 0.79 ppm for June to 5.6 ppm for October. The primary standard is 0.24 ppm over a 3-hour period.

Water quality has been monitored at the site since 1982. There are seven monitoring stations in Blue Lake and three in Mud Lake. One station in each lake is located away from the shoreline and acts as a control station, while the others are located along the shore to monitor the effect of runoff. Parameters monitored include pH, salinity, alkalinity, temperature, DO, TOC, chemical oxygen demand (COD), nitrate, nitrite, orthophosphate, iron, calcium and magnesium.

The pH of the water is moderately basic, having ranged from 7.2 to 10.2 in Blue Lake and 7.3 to 8.8 in Mud Lake. In general, Blue Lake is usually slightly more basic than Mud Lake. The salinities of the lakes are variable, ranging from 4 to 9 ppt for Blue Lake and from 6 to 31 ppt for Mud Lake during 1984.

The DO is usually adequate, dipping below 5 ppm only on isolated occasions in the summer (attributed to seasonal factors). The TOC is usually below 20 mg/l, although it often rises during the spring and early summer plankton bloom. The COD is much more variable, ranging from non-detectable to highs of 725 mg/l in Blue Lake and 1200 mg/l in Mud Lake. The COD of Mud Lake is generally higher than that of Blue Lake. Variations are attributed to seasonality.

The three ground water monitoring wells at Bryan Mound are located in the northwest corner of the brine pond, northeast of cavern 3, and in the laydown yard southeast of cavern 3. The wells have been sampled for pH, salinity, COD, temperature, specific conductance, alkalinity, DO, and iron. The pH is usually slightly acidic, ranging from 5.96 to 7.71. Well 1 is usually the most acidic, while well 2 is the most basic. The COD has ranged from less than 25 mg/l to 828 mg/l, although it is usually below 100 mg/l. The COD tends to peak in the spring and early summer. The DO is typically between 1 and 2 mg/l, except at times of high COD. Wide variations in salinity have been found, and are thought to be due to proximity to the salt dome and to the interconnection of various aquifers.

3.4.4 St. James

3.4.4.1 Ecology

Surrounding facilities and structures essentially block all surface water flow away from St. James Terminal. These structures include the Texas and Pacific Railroad to the west, oil terminal facilities to the north and south, and the Mississippi River levee to the east. The area adjacent to the Mississippi River at the St. James docks is considered a freshwater wetland (batture). Much of the non-industrial land area surrounding the terminal is used for pasture and sugar cane cultivation. This land is covered by a mixture of introduced cool and warm season grasses and legumes. Frogs, snakes, turtles, cottontail rabbit, raccoon, armadillo, muskrat, opossum, nutria, squirrels, egrets, ibis, and herons can be found on the site and in the surrounding areas.

3.4.4.2 Geology, Hydrology, and Soils

The St. James SPR site is not located atop a salt dome, thus characteristics and effects attributable to such a geomorphic feature are not addressed. Due to the agricultural history of the area and the entirely surface nature of the St. James SPR operation, this discussion focuses on surface and near surface features.

The majority of the soil at St. James is classified as silty clay loam of the Sharkey series. Commerce silt loam is also identified, as well as small areas of Commerce silty clay loam, Sharkey clay, and Vacherie silt loam.

Sharkey series soils are characterized as poorly drained and very slowly permeable. Sharkey silty clay loam has a 5 to 16 inch thick surface layer of dark grayish brown or dark gray silty clay loam, over a gray or dark gray clay with brownish mottling. Sharkey clay has a similar subsoil with a surface layer of dark gray clay.

Commerce soils have moderately slow permeability and are somewhat poorly drained. Commerce silt loam has a 6 to 15-inch thick dark grayish brown silt loam surface layer, over a subsoil of stratified grayish brown silty clay loam and brownish mottled gray silt loam. Commerce silty clay loam has a 6 to 15-inch thick surface layer of dark grayish brown or dark gray silty clay loam, with a stratified subsoil of brown, yellow and gray mottled grayish brown silty clay loam and silt loam.

Vacherie silt loam is very slowly permeable and somewhat poorly drained. It has a 6 to 15-inch thick surface layer of dark grayish brown silt loam over a subsoil of either grayish brown silt loam or sandy loam with brownish mottles. Below the subsoil, at a depth of 15 to 36 inches, is a layer of gray or dark gray clay.

Ground water in the area tends to be influent to the Mississippi River and strongly influenced by river stage. Drainage outside of the Mississippi levee, including the terminal, is directed to the west by a series of drainage ditches into St. James Bayou. All surface drainage in the immediate vicinity of St. James Terminal is intermittent in nature.

3.4.4.3 Air and Water Quality

A study of air quality was performed from September, 1982 to October, 1983. Parameters measured included NMHC, TSP, and ozone.

The monthly geometric mean value for TSP varied from 27.7 ug/m^3 in January to 87.3 ug/m^3 in September, with an overall average of 44.3 ug/m^3. The highest value recorded was 131 ug/m^3. The primary standards are a 75 ug/m^3 annual geometric mean and a 260 ug/m^3 24 hour maximum. The highest hourly ozone value recorded was 0.167 ppm. Monthly averages of the highest daily values ranged from 0.032 ppm in December to 0.080 ppm in August. The primary standard is 0.12 ppm hourly. The monthly average of the maximum hourly concentration of NMHC varied from 0.52 ppm in September to 5.35 ppm in November. The primary standard is 0.24 ppm over a 3-hour period.

The only surface water in the vicinity of the site is the Mississippi River. The site docks extend into the Mississippi River; however, its high volume and assimilative capacity would prevent detection of any but the most chronic and severe pollution events. No water quality monitoring of surface or ground water is conducted at St. James.

3.4.5 Sulphur Mines

3.4.5.1 Ecology

The site is divided into two areas, the quadrangular primary area and the figure-eight shaped secondary area. The secondary site area is bordered on the west, northwest and north by water. Most of these bodies of water are interconnected and drained by one creek flowing eastward from the site to Bayou D'Inde. A floodwater canal is located a quarter of a mile east of the site. Changes in elevation throughout the site are minor, with most of the site 15 to 20 feet above sea level. The site proper is normally dry; however, flooding sometimes occurs in the spring. The lowest elevations are over the center of the dome, where subsidence has occurred as a result of prior sulfur mining activity. Much of the surrounding area is covered with a mixed pine/hardwood forest. The cultivated farmland west and northeast of the site was previously swamp land.

Mammals found on and around the site are white-tailed deer, raccoon, fox, squirrel, cottontail rabbit, opossum, striped skunk, armadillo, nutria, southern flying squirrel, white-footed mouse, and bobcat. Snakes, turtles, American alligator, frogs, and toads can also be found. Crappie, large mouth bass, sunfish, gar, carp, bowfin, and catfish inhabit the shallow ponds on and around the Sulphur Mines site.

3.4.5.2 Geology and Soils

The Sulphur Mines salt dome is a small piercement dome connected at depth to a much larger salt pillow. Edgerly salt dome, about 5 miles west of Sulphur Mines, is a similar salt piercement dome connected to the same salt pillow structure.

The area is characterized by low topographic relief with a gentle gulfward slope, only interrupted by the influence of the Sulphur Mines salt dome. Across the dome, ground elevations range from less than 4 feet in the central depressed area to 14 to 20 feet along the perimeter road. These topographic features are the result of mining activities.

Soils in the site area generally consist of uncemented, unlithified deposits of sand and silt with clay predominating. In general, the entire site area is underlain by soils of the Prairie Formation overlain by more recent geologic deposits and very recent man-placed fill.

The soils of the Prairie Formation consist predominantly of clay to silty or sandy clay with thin sand and silt laminae. Recent soils overlying the Prairie are generally gray clays and silts, consolidated with high moisture content and lower shear strength than the stiffer Prairie Formation soils. Recent soils are thickest in the area immediately west of the dome and generally absent over the dome.

Fill was placed as sulfur was mined and subsidence occurred, to prevent flooding, fill sink holes, and to provide a working platform. The majority of fill material, generally soft to firm clay, was placed with hydraulic dredges in the actively mined areas directly over the dome. The fill soils, interlayered with sand and silt pockets, were consolidated only by their weight and some surface desiccation.

3.4.5.3 Hydrology and Hydrogeology

The Sulphur Mines salt dome is located in the Calcasieu River basin. Major surface water features in the region include the Calcasieu River to the east, the Houston River and Sabine River Diversion Canal to the north, the Sabine River to the west, and the Intracoastal Waterway to the south. Surface water features in the immediate vicinity of the site include Bayou Choupique and Bayou D'Inde, marshes, canals, ponds, reservoirs, the Brimstone Ditch, and numerous site drainage ditches.

The area over the dome has subsided due to sulfur mining activities. Since there is no no natural outlet, the area holds water. Water levels are maintained at elevations between +5 and +10 feet msl through intermittent operation of a dewatering system. Local surface drainage is generally poor, collecting in depressions, ditches and lakes, and percolating slowly through the clayey soils.

Shallow alluvial aquifers supply small amounts of water for domestic use in Calcasieu Parish. The Chicot Aquifer system is the principal and most heavily pumped source of ground water in the Parish. The Evangeline and deeper aquifers are saline in the vicinity of Sulphur Mines. The salt mass at Sulphur Mines is sealed from ground water by 5 to 10 feet of clay, locally diverting ground water flow around the dome without affecting water quality.

All fresh ground water in the Chicot Aquifer system is believed to have originated as precipitation. Intrusion from deeper saline aquifers into the Chicot aquifer system has increased due to extensive ground water withdrawals in the Lake Charles area. The Chicot Aquifer is no longer artesian in the Lake Charles area, as observed in the early 1900s.

The Chicot Aquifer system consists of three fairly extensive fresh water beds of sand, referred to as the "200," "500," and "700" foot sands. The top of the "200-foot" sand occurs over the caprock at an average elevation of -65 feet msl, with an average thickness of 155 feet. The top of the "500-foot" sand occurs over the caprock at an average elevation of -280 feet with and a thickness of less than 100 feet. This sand is separated from the overlying "200-foot" sand by a fairly continuous clay or silt bed with an average thickness of 60 feet. The "700-foot" sand is thin or absent over the caprock.

The Evangeline Aquifer occurs between -800 and -2,800 feet msl near the site. The Evangeline is separated from the underlying saline aquifer by the 200 to 500-foot thick Burkeville calcareous clay aquiclude. Ground water flow in the Evangeline Aquifer is generally toward the southeast, with some local pumpage effects.

3.4.5.4 Air and Water Quality

A study of air quality was made from September, 1982 to October, 1983. Parameters measured included NMHC, TSP, and ozone.

The monthly geometric mean value for TSP varied from 21.4 ug/m^3 in November to 58.6 ug/m^3 in July with an overall mean of 37.1 ug/m^3. The highest value recorded was 110 ug/m^3. The primary standards are a 75 ug/m^3 annual geometric mean and 260 ug/m^3 24-hour maximum. The highest hourly ozone value recorded was 0.451 ppm. Monthly averages of the highest daily values ranged from 0.039 ppm for December to 0.083 ppm for October. The primary standard is 0.12 ppm hourly. The monthly average of the maximum hourly concentration of NMHC varied from 1.88 ppm for December to 11.5 ppm for July. The primary standard is 0.26 ppm in a 3-hour period.

Water quality at the site has been monitored since 1982 at a drainage ditch at the northwest corner of the primary site, the creek north of the primary site, the subsidence area, the impoundment north of Cavern 6, the impoundment west of Cavern 7, and the raw water intake structure. Parameters measured include pH, salinity, total dissolved solids (TDS), TSS, temperature, and oil and grease.

The pH tends to be somewhat acidic at the stations in the drainage ditch and the creek, and neutral to slightly basic at the other stations, with an overall range of 3.5 to 8.5. Most of the water may be classified as oligohaline (0.5 to 5 ppt salinity), except for the water at the raw water intake, which is limnetic. Oil and grease have been found on only six occasions, (the highest level was 7.4 mg/l), in the four years of sampling. These data have generally been attributed to oil production and other industrial activity in the area.

There are no ground water monitoring facilities at Sulphur Mines.

3.4.6 Weeks Island

3.4.6.1 Ecology

The surface expression which forms the island over the salt dome includes the highest elevation (171 feet) in southern Louisiana. The area surrounding the island is a combination of swamp, marsh, bayous, man-made canals, and bays contiguous with the Gulf of Mexico.

The vegetation on Weeks Island is quite varied because of the higher elevation afforded by the island and the presence of very fertile loam as a soil base. The dominant trees are oak, magnolia, and hickory, which extend down to the surrounding marsh. Pecan trees are also present. The coastal wetlands found at the Weeks Island site include the man-made Intracoastal Waterway, saline and brackish marshes, and bayous.

Gulls, terns, herons, and egrets are commonly found in and around the marshes. Mink, nutria, river otter, raccoon, and American alligator are the most common inhabitants of the intermediate marshes. Other fauna found in the Weeks Island environs are opossum, bats, squirrels, swamp rabbit, bobcat, white-tailed deer, black bear, and coyote. The water bodies surrounding Weeks Island provide a vast estuarine nursery ground for an array of commercially and recreationally important fish and shellfish.

3.4.6.2 Geology and Soils

The topographic expression of the Weeks Island salt dome is two miles in diameter, with a maximum elevation of 171 feet. The topography is hilly, with gullies 20 to 60 feet deep in one area of the island. A topographic scarp trending north-northeast across the middle of the island probably represents the surface expression of a boundary shear zone in the salt. To the east of the scarp, an internal valley, characterized by a line of sink hole lakes as it crosses the island, is probably also related to the boundary shear zone. Some of the other aligned valleys may also represent shear zones in the salt.

Exploratory drilling at Weeks Island has not revealed the presence of a caprock typical of many Gulf Coast domes. Except for a few minor pockets of methane, no cavities associated with caprock formation have been found at the top of the salt. A few feet of organic clay lying immediately over the salt is overlain by sands of the Pleistocene Prairie formation. The completion reports of the vent hole and oil fill holes indicate gumbo shale/sand to within 10 to 20 feet of the salt, with sand directly overlying the salt. These reports indicate top of salt is -102 feet msl at the vent hole and -135 feet msl at the fill holes.

3.4.6.3 Hydrology and Hydrogeology

Weeks Island is on the northern edge of the AtchafalayaVermilion estuarine complex. The island is rimmed by shallow brackish bays and intermediate waters to the north, salt marshes to the south, and Weeks Bay to the west. Springs are common on the northern slopes of the island. Levels of fresh water ponds on the island may vary from 15 to 60 feet above sea level, suggesting that much of the shallow ground water is perched located impervious horizons at varying elevations. The most important navigational body of water in the area is the Intracoastal Waterway.

The Chicot is the principal aquifer in the area, with a piezometric surface at approximately sea level near Weeks Island, and sloping slightly northwest towards the Lake Charles area. Near the coast, the fresh water of the Chicot gradually becomes saline at 300 to 600 feet. Many of the smaller localized shallow sands that overlie the "upper sand unit" contain saline water; however, some are fresh, providing water for local areas. The water-bearing sands above the salt at Weeks Island probably represent the shallow sand aquifers of the Chicot.

3.4.6.4 Air and Water Quality

A study of air quality was made from September, 1982 to October, 1983. Parameters measured included NMHC, TSP, ozone, hydrogen chloride, and chlorine.

The monthly geometric mean value for TSP varied from 62.2 ug/m^3 in August to 109.8 ug/m^3 in February, with an overall mean of 84.4 ug/m^3. The highest value recorded was 344.7 ug/m^3. The primary standards are a 75 ug/m^3 annual geometric mean and a 260 ug/m^3 24-hour maximum. The highest hourly ozone value recorded was 0.136 ppm. Monthly average of the highest daily values ranged from 0.023 ppm for October to 0.081 ppm for August. The primary standard is 0.12 ppm hourly. The monthly average of the maximum hourly concentration of nonmethane hydrocarbons varied from 0.18 ppm for April to 1.09 ppm for August. The primary standard is 0.24 ppm in a 3 hour period. Chlorine and hydrogen chloride, released by a neighboring manufacturing plant, were undetectable during about 75% of the study. The highest values measured were 2.4 ppm hydrogen chloride and 2.8 ppm chlorine.

No surface or ground water quality monitoring has been conducted at Weeks Island. There are no surface water bodies in the area of the site that could be affected by site operations.

3.4.7 West Hackberry

3.4.7.1 Ecology

Waterways bordering the West Hackberry site include Calcasieu Lake and the Calcasieu Ship Channel approximately three miles to the east, and the Intracoastal Waterway approximately four miles north of the site. Water bodies in the area of the site are connected to the Intracoastal Waterway by the north-south running Alkali Ditch. Black Lake, a brackish water lake, borders the northern and western sides of the island formed by the upwelling of the salt dome. Numerous canals and natural waterways, including Kelso Bayou, connect Black Lake to the Alkali Ditch on the eastern side of the site. Kelso Bayou wanders in a generally easterly direction from Black Lake, eventually connecting with the Calcasieu Ship Channel northeast of the town of Hackberry. A nearby canal that runs northeast to southwest connects Alkali Ditch directly with the eastern side of the site.

The western part of Cameron Parish consists of marshland with cheniers extending in a generally east-west direction. These cheniers play a role in directing water flow through the marshes and supporting grasses and trees. In many areas, lakes, bayous, and canals are concentrated so that the marsh may not seem to be a land mass at all, but a rather large region of small islands. Marshland closest to the coast generally has the highest salinity levels and lowest species diversity. Vegetation found on site and in the surrounding area of the West Hackberry facility is dominated by Chinese tallow, bay, wax myrtle, live oak, and various species of marsh grass and upland crop grasses. Red fox, American alligator, snakes, egrets, herons, roseate spoonbill, raccoon, nutria, opossum, rabbit, white-tailed deer, migratory waterfowl, and red-tailed hawk can be found on and in the area surrounding the West Hackberry facility. Aquatic inhabitants of Black Lake include crab, drum, croaker, spot, sheepshead, shrimp, mullet, gar, redfish, oyster, and catfish.

3.4.7.2 Geology and Soils

The West Hackberry salt dome is located on the northwest flank of the Calcasieu Lake salt withdrawal basin, at the western end of the Hackberry salt ridge. This ridge is about 4.5 miles long and 1.5 miles wide with surface elevations of +21 to +25 feet msl. The site is situated on the elevated surface expression of the West Hackberry dome.

Marshlands surrounding the dome are generally less than 2 feet above sea level. The West Hackberry SPR Site has elevations ranging from +5 to +20 feet msl.

The soils at the West Hackberry consist of a surface veneer, predominantly of silts, overlying the Prairie Formation clays. The soil units at the West Hackberry SPR Site appear to be very similar to late Pleistocene soils throughout the Gulf Coast. The three major strata may be characterized as:

Stratum 1	Surface veneer of light gray to light brown silt or sandy silt; generally collapsible.
Stratum 2	Upper 40 to 45 feet of firm to very stiff desiccated clays, locally sandy and/or silty.
Stratum 3	Below about 45 feet, the stratigraphy generally remains a stiff to very stiff desiccated clay with occasional thin layers of silt and/or sand.

3.4.7.3 Hydrology and Hydrogeology

The West Hackberry SPR Site is located in the southern part of the Calcasieu River basin, encompassing a drainage area of approximately 4,450 square miles. Tributaries located in the upper 3,170 square miles of the basin range from flat, sluggish streams to moderately flowing streams. The southern portion of the drainage basin, including the vicinity of the West Hackberry SPR Site, is flat marshland dotted with several lakes. The largest of these is Calcasieu Lake, which covers an area of approximately 75 square miles. The Calcasieu River flows into Calcasieu Lake and ultimately empties into the Gulf of Mexico, about 5 miles south of the lake, through Calcasieu Pass. Black Lake is connected with the Calcasieu Lake system through Kelso Bayou.

A major portion of the lower Calcasieu River basin is tidally influenced. The associated coastline is characterized by a narrow, wave-cut beach and a landward series of beach ridges, beyond which lie coastal marshes. There are none of the barrier islands or bays found in other parts of the Gulf Coast region.

The primary fresh water aquifer in the Hackberry area is the Chicot. Water-bearing sands of the Chicot Aquifer, designated "A," "B," and "C", are found at depths of about 200 feet, 500 feet, and 700 feet at West Hackberry. In the site area, the "A" sand is approximately 50 feet thick, grading from a coarse sand and gravel at the base up to a fine to medium-grained sand. The "B" sand, separated from the "A" by 250 feet of clayey material, is approximately 150 to 200 feet thick and exhibits the same fining upward sequence as the "A" sand. The "B" sand is separated from the 200-foot thick "C" sand by approximately 50 to 60 feet of clayey material with local thinning and interconnecting sands, resulting in considerable hydraulic communication. Through most of its extent, the underlying saline Evangeline Aquifer is separated from the "C" sand by approximately 100 feet of clayey material, with some local hydraulic connections. Pumping in the Lake Charles area, has reversed the Chicot piezometric slope from southward to northward.

Overlying the Chicot "A" sand at depths less than 100 feet are aquifers composed of oyster shells and associated silty sands, usually yielding small quantities of water for domestic and rural supplies. These shallow aquifer sands, because of their proximity to the surface, are relatively significant to the West Hackberry SPR Site.

Aerial photographs illustrate that during the past 25 years the surface area of Black Lake has increased from about 4 square miles to nearly 50 square miles. This change in lake size is attributed to saltwater intrusion and an estimated 3 to 5 feet of subsidence occurring since 1933. Large-scale withdrawal of hydrocarbons and concomitant production of brine may have resulted in compaction of confining materials and surface subsidence, increasing the size of Black Lake. The shoreline of Calcasieu Lake and the Gulf of Mexico do not show the similar changes as expected if regional subsidence or sea level change had occurred since 1930. Thus, the increase in the area of Black Lake is considered a local phenomena.

3.4.7.4 Air and Water Quality

A study of air quality was made from September, 1982 to October, 1983. Parameters measured included NMHC, TSP, and ozone.

The monthly geometric mean value for TSP varied from 31.1 ug/m^3 in November to 114 ug/m^3 in July, with an overall average of 50.4 ug/m^3. The highest value recorded was 145.1 ug/m^3. The primary standards are a 75 ug/m^3 annual geometric mean and a 260 ug/m^3 24-hour maximum. The highest hourly ozone value recorded was 0.213 ppm. Monthly averages of the highest daily values ranged from 0.032 ppm for December to 0.086 ppm for August. The primary standard is 0.12 ppm hourly. The monthly average of the maximum hourly concentration of NMHC varied from 0.07 ppm for February to 2.25 ppm for September. The primary standard is 0.26 ppm in a 3-hour period.

Water quality has been monitored at five stations since 1982. Three of these are in Black Lake, one is in the southeast drainage ditch, and one is in the ditch draining the high pressure pump pad. Parameters monitored include pH, salinity, temperature, oil and grease, TDS, TSS, and TOC. The pH is usually neutral to somewhat basic, ranging from 6.7 to 8.8. The salinity of Black Lake may be classified as mesohaline (5 to 18 ppt). Salinity measurements in the drainage ditches vary, due to occasional leakage of brine pump seals and brine spills, but are inconsequential to Black Lake. The TDS is generally high, due to the ambient salinity, and TSS generally reflects ambient conditions. Oil and grease have been detectable occasionally in the high pressure pump pad ditch (highest level 33.8 mg/l), and on one occasion in Black Lake, due to a non-SPR oil spill. Observed TOC measurements are typical for natural waters.

There are ground water monitoring wells located next to the brine pond and Well Pads 8, 9, and 11. These wells are sampled monthly for pH and salinity. The pH tends to be somewhat acidic, ranging from 4.0 to 7.1. Salinities are usually in the oligohaline range by the well pads and mesohaline at the brine pond. The highest salinity observed was 17 ppt, in the well near the brine pond. The lack of well log data precludes meaningful interpretation of the groundwater monitoring results.

4. FINDINGS

4.1 BAYOU CHOCTAW

4.1.1 Past Activity

The Bayou Choctaw salt dome was discovered in 1926 by Gulf Oil and Refining Corporation. At that time, the land was owned by Wilbert's Myrtle Grove Planting and Manufacturing Company, which later became Wilbert's & Sons Lumber and Shingle Company. In 1930 and 1931, eight sulfur exploration wells were drilled, but no sulfur was found. Drilling for oil started in 1931, and since then, over 300 oil and gas wells have been drilled on the perimeter of the dome. Although production reached a plateau from the late 1930s through the early 1950s, some production is ongoing today.

In 1934, the Solvay Process Company obtained a salt lease for the property over the dome, and began drilling brine wells. Some of these wells are currently used for oil storage by DOE. Solvay eventually merged into Allied Chemical, which occupied the site until DOE acquisition.

Allied Chemical's major use of the property was brine production, although caverns have been used for ethane and ethylene storage. According to C. Webb (Allied's current Bayou Choctaw facility manager, who has been employed there for 30 years), heavy metals were not used in their muds when drilling brine and storage wells. Mud and cuttings from Allied (now DOE) caverns 18, 19 and 20 were deposited in adjacent pits and covered in place when the wells were drilled. DOE later removed and disposed of those mud pits, as discussed in Section 4.1.2.

A caustic liquid has been identified in cavern 10 by DOE contractor personnel. According to Allied, this compound is a potassium hydroxide solution, which is probably present in the well casing string only. Two carbon dioxide treatment units, approximately 4½ feet in diameter and 18 feet tall (573 ft^3 combined volume), containing potassium hydroxide briquets were emptied by dissolution. The briquets were dissolved in an estimated three volumes of water, generating approximately 12,600 gallons of potassium hydroxide solution, which was then injected into the well. Volume calculations indicate that a portion of the caustic solution may have dispersed into the brine in the cavern.

There are nine other inactive caverns on DOE property remaining from previous brining activities. Allied indicated that these caverns were not used for disposal of any wastes, although documentation of all cavern uses was not available. DOE has never used these caverns for the injection or disposal of wastes.

A major environmental incident, the creation of Cavern Lake, occurred as a result of Allied's operations. The roof and overburden above Cavern 7 collapsed in January, 1954. The resulting crater filled with water from Bayou Bourbeaux.

4.1.2 DOE Activity

DOE occupies an area directly over the Bayou Choctaw salt dome. DOE activities on this site include facilities construction, leaching solution-mined caverns, drilling and operating brine disposal wells, and storage of crude oil in solution-mined caverns. These activities are unlikely to generate hazardous waste. Phase I caverns 15, 18, 19, and 20 are former Allied brine caverns now used for SPR oil storage. Cavern 102, drilled by the SPR, was exchanged for Allied cavern 17, which had formerly been used for ethane storage. Phase III cavern 101 has been drilled, but not yet leached. Twelve brine disposal wells, located south of the main site area, are operated by the SPR.

Detailed descriptions of drilling mud additives used by the SPR are available for well 102A only. Five sacks of Q-Broxin®, a chrome lignosulfonate mud additive, were added to the drilling mud for this well. Descriptions of the muds used for drilling other wells do not indicate that metal-containing mud additives were used there, with the exception of brine disposal well 1, where Spersene®, a chrome lignosulfonate, was added.

Chrome lignosulfonate is a deflocculant mud additive. Q-Broxin®, a typical chrome lignosulfonate, manufactured by NL Baroid, contains approximately 3% chromium, by weight. Based on a typical addition of 1 to 20 pounds per barrel of mud (API Bulletin 13F), the resulting mud would have a chromium content ranging from approximately 60 to 1500 ppm.

Chromium is a hazardous substance and a constituent of EP (extraction procedure) toxicity (EPA hazardous waste number D007). A waste is considered hazardous if the extract contains over 5 mg/l of chromium in the hexavalent state. Therefore, sampling and analysis is required to determine whether a chromium-containing waste is hazardous.

All SPR drilling fluids were either disposed off site or in a disposal area near brine disposal wellpad 1. Mud pits abandoned by Allied at wellpads 18, 19, and 20 were moved to the onsite disposal area and cement stabilized. The fate of the mud used to drill brine disposal well 1 could not be ascertained, but it is thought to have been disposed at this area. Additionally, brine pond liners and miscellaneous items were also disposed at the brine disposal well pad area. Typical flora and fauna were found at the disposal area. Animal tracks, lush vegetation and a variety of aquatic organisms were observed in and around standing water there. No dead animals or indications of plant stress were seen. Similar observations were made in the area where known mud pits were formerly located. The mud used in drilling well 102 was disposed off-site.

No other activities involving potential generation of hazardous waste were identified at the Bayou Choctaw site. All wastes generated during construction were removed and disposed off site, according to SPR employees present at that time. This site is currently used for the storage of crude oil only. DOE operates a water quality laboratory on site, for NPDES analyses, but this laboratory does not generate hazardous wastes. Physical inspection of the site showed no adverse environmental impacts.

The site, assigned RCRA generator number LA 389009001 in response to 1980 notification, was reclassified to non-handler status in 1982. Site generated wastes consist of nonhazardous solid waste and oil field waste. These wastes are disposed in accordance with applicable regulations. This site has not generated or disposed of any hazardous waste.

4.1.3 Conclusions

Past activities could have produced sufficient contamination to meet a hazardous substance criteria in two general areas; the unused Allied caverns and the mud disposal area by brine disposal wellpad 1. The fluid found in cavern 10 could meet the hazardous waste criteria for corrosivity (pH above 12.5). The risk of migration is low, because the waste is contained in the cavern. Chromium-containing mud is likely to have been disposed in the mud disposal area. Although the mud disposal area is unlined, the potential for migration has been lowered by stabilization. Preliminary Uncontrolled Site Hazardous Waste Ranking System (HRS) worksheets are included in Appendix A.

4.1.4 Recommendations

It is recommended that a sample be taken via bleed off from cavern 10 and analyzed for corrosivity and EP toxicity. Any further analyses will be considered after receiving the results of this analysis. The potential threat of a release of cavern 10 fluid to the environment is quite low, since the waste is isolated in the salt cavern and associated casing. In addition, potassium hydroxide may be readily neutralized or buffered.

The other inactive Allied caverns should also undergo sampling for pH and EP toxicity prior to the commencement of any work there, since no historical data is available. These data will substantiate cavern fluid characteristics at minimal cost and without the risk of unnecessarily damaging wellheads.

It is recommended that the mud disposal area by brine disposal wellpad 1 be sampled and analyzed for EP toxicity.

4.2 BIG HILL

4.2.1 Past Activity

The Big Hill SPR site was used primarily as pasture prior to its acquisition by DOE. Sulfur exploration wells drilled on the site were non-productive and plugged. One oil well drilled on site was also non-productive and plugged.

Industrial activities in the area were limited. Amoco operates producing oil wells south of the site, and had some facilities on the site prior to DOE acquisition. An Amoco operated tank area, brine disposal well, and mud pit were located in the southeast part of the site. The SPR warehouse was constructed over the former tank area. No visible contamination was identified during excavation and construction in the area. The brine disposal well was located in the vicinity of the site entrance. According to Amoco, this plugged and abandoned well had been used strictly for brine disposal for the oil wells in the area. The mud pit was used for mixing drilling muds. This pit was cleaned out and covered by Amoco, leaving it indistinguishable from the surrounding area.

A brine disposal well is located off the southwest corner of the site. Tanks for the well, formerly located on the site, were moved offsite after DOE acquisition. The former tank location was covered over by topsoil from site well pad construction. A remnant diked area, the purpose of which is unknown, is also now covered by this topsoil. Aerial photographs show this area as fully vegetated prior to being covered. To the north of the tank dikes, photos show some cleared areas which have also been covered by topsoil. The origin of these areas is unknown; however, there is no evidence of any hazardous waste sites. An Amoco saltwater line, which has since been relocated, formerly ran through the topsoil disposal area.

4.2.2 DOE Activity

DOE activity to date has consisted of construction of the facilities and drilling of the wells. No leaching has taken place. During well pad construction, the construction contractor disposed of topsoil on site. Cuttings ponds were constructed on site for disposal of drill cuttings. Drilling muds were also deposited in these freshwater and saltwater cuttings disposal ponds. The DOE contractors disposed of all other wastes off site.

A former employee of Drillers Inc., one of two drilling contractors at the Big Hill SPR site, stated that chrome lignosulfonate was added to the mud used to drill several of the wells. An employee of the cavern engineering contractor stated that he saw sacks of this additive present on site. Although the IADC (International Association of Drilling Contractors) reports for the site do not list chrome lignosulfonate as having been added, an additive identified as "CLS" was listed for several wells. This was identified as a lost circulation material by an employee of the construction management contractor, but is also listed as a trade name for chrome lignosulfonate by the API (American Petroleum Institute).

Drillers Inc. drilled wells 101A through 105B and 111A through 114B. The contractor was to replace the drilling fluids with clean brine after completion of each well, but unusually colored and high-viscosity fluids have been found in several of the wells drilled by Drillers Inc. Organic chemical contamination has been found in some of these fluids. Preliminary qualitative analysis showed one sample to contain a grease and another to contain small quantities of organic contaminants, including the hazardous substances toluene and 1,1,2,2,-tetrachloroethane, and the hazardous constituent 1,3-dichloro-2-propanol. Analytical results also showed the presence of hydrocarbon contaminants in wells 111A, 112B, 113A, 113B, and 114B. A former employee of Drillers Inc. stated that these contaminants may have originated from the disposal well operation located southeast of the site. Use of this site had been leased by Drillers Inc. Spilled oil from the holding tanks at these wells was allegedly pumped into the SPR wells by Drillers Inc.

4.2.3 Conclusions

No evidence of on-site hazardous waste contamination or disposal originating prior to DOE acquisition was found. Several hazardous substances have been identified in SPR wells; however, they may not be present in sufficient concentration to constitute a hazardous waste or present a threat to the environment. These compounds will not migrate since they are contained by salt, under positive pressure. The use of chrome lignosulfonate in drilling muds may have contaminated the cuttings ponds with chromium. The ponds are lined with a synthetic liner, minimizing the risk of contamination migration. No other DOE activity has resulted in hazardous waste contamination. Preliminary HRS worksheets are shown in Appendix A.

4.2.4 Recommendations

Fluids from all wells should be sampled at several levels and subjected to quantitative analysis. Specific analyses should include EP toxicity determination and a priority pollutant scan.

This sampling should take place concurrent with ongoing DOE activity to minimize expense. Leaching should not commence prior to analysis and completion of the selected remedial action, if warranted.

The soil in the cuttings ponds should be sampled to determine the concentration of chromium, using EP toxicity. Closure of the cuttings ponds should be postponed until results of these analyses have been received, since the presence of hazardous characteristics in the drill cuttings will affect the closure plan.

4.3 BRYAN MOUND

4.3.1 Past Activity

There has been a long history of industrial activity on the Bryan Mound site. The two major activities were production of sulfur, which started in 1912, and production of brine, starting in 1942.

The majority of sulfur mining was performed by Freeport Sulphur Company between the years 1912 and 1935, using the Frasch process. Blue Lake and Mud Lake remain from sulfur mining activity, Blue Lake having been a reservoir and Mud Lake a mud source. Two areas of solidified tar are the probable remains of crude oil fuel tanks used in sulfur mining operations. They have been the subject of concern by the EPA and of investigation by DOE. Tarry soil in the northern area is one half-inch thick, covers about 15 square feet, and has since become revegetated and is nearly undiscernable from the surroundings. A much larger southern area consists of four separate areas of tar cake and tarry soil in close proximity to each other. Three of the areas are about one half-inch thick, dry, asphalt-like material. The fourth area is six to twelve inches of tar-like material. The cumulative surface area of the four areas is approximately

3500 square feet. Priority pollutant analysis by total extraction showed two organic and four inorganic contaminants present at concentrations over 1 ppm in the south tar area, and nine organic and six inorganic contaminants at concentrations over 1 ppm in the north tar area. Cyanide, at 107.7 ppm in the south tar area, and zinc at 68.5 ppm and anthracene at 65 ppm in the north tar area, were the contaminants of highest concentration. EP toxicity analysis of the same samples showed no constituents at concentrations greater than the EPA limit.

Monsanto Chemical Company drilled sulfur exploration wells in 1952, but did not produce any sulfur. In 1966, Hooker Chemical Company obtained the sulfur rights, and conducted pilot operations for approximately 14 months in 1967 and 1968. Hooker notified the EPA (103(c) CERCLA), in 1981, that asbestos insulated pipe might have been disposed on the site. A former Hooker employee familiar with the 103(c) notification and pilot Frasch plant operations stated that the notification was made in 1981 as a defensive measure, and that if asbestos was present, it was probably in a non-friable matrix form. No asbestos has been found on site. Defensive 103(c) notifications were not uncommon in 1981, because many companies were concerned about their potential liability under CERCLA, should they notify EPA that no waste disposal existed on their site only to discover evidence of such prior activity at a later date. Dow disposed of approximately 100 pounds of asbestos into caverns 4 and 5, along with sodium carbonate. The wells were sampled by Dow in 1977, and asbestos was found in a concentration of 0.5 ppb in both wells. Water sampled from the Brazos River Diversion Channel (the leach water source), at the same time, had an asbestos concentration of 1.5 ppb.

Brine was produced at the site by Dow Magnesium Corporation, which later became Dow Chemical Company. Five caverns resulted from Dow operations. Of these, caverns 1, 2, 4, and 5 are now the four Phase I SPR oil storage caverns. A sixth well was drilled, but not developed. This well blew out in 1978 releasing hydrogen sulfide and methane. The well has been plugged, and is no longer visible. Dow conducted brining operations until the site was purchased by DOE in 1977.

An abandoned surface impoundment, used by Dow in brining operations, has been investigated by EPA and DOE. Priority pollutant analysis of the substrate indicated cyanide at 112.9 ppm, and eight inorganic contaminants present at concentrations greater than 1 ppm. Zinc was the inorganic contaminant of highest concentration, at 58.1 ppm. EP toxicity analysis identified no contaminants exceeding the EP criteria. Only nickel (14.3 ppm) and zinc (1.58 ppm) were found at concentrations greater than 1 ppm under the extraction procedure.

The city of Freeport operated two municipal landfills on the property prior to DOE acquisition, one during the 1960's and one from 1976-1977. The disposal of industrial waste into the landfills was strictly prohibited by the city. Priority pollutant analysis of two samples from the landfill area showed only inorganic contaminants present in excess of 1 ppm. In both samples, zinc was found at the highest concentrations, 85.5 and 74.4 ppm. EP toxicity analysis for both samples was negative. The only organic found using the extraction procedure was beta-BHC, a pesticide, in a concentration of 2.5 ppb.

Bryan Mound has never been a major site of oil production. A few wells were drilled on the perimeter of the dome, off of DOE property.

4.3.2 DOE Activity

Major DOE activity at Bryan Mound has consisted of construction of facilities, drilling and solution mining new caverns, and storage of crude oil in both new and previously constructed solution mined caverns. These activities do not typically generate hazardous waste.

During construction, no evidence of prior on site waste disposal was found. Excavation was conducted over the majority of the site and it is likely that any abandoned disposal areas would have been encountered at that time.

The Bryan Mound facility submitted Part A of its RCRA §3005 permit application in 1980 and was assigned generator number TX 0890032584. In 1981, the RCRA application was withdrawn and in June, 1982 the SPR was notified that the site had been reclassified to nonhandler status by the EPA. Hazardous wastes were disposed of on two occasions. The most recent was the disposal of 275 gallons of hydrochloric acid in June, 1984. Peterson Maritime Services removed and disposed the acid at the Chemical Waste Management facility in Port Arthur, Texas. A PCB (polychlorinated biphenyl) contaminated transformer was retro-filled during 1981, with removal of 22 drums of contaminated material. This work was performed in strict compliance with the Toxic Substance Control Act by Peterson Maritime Services, Inc. Chemical Waste Management, Inc. disposed this material in its Emelle, Alabama facility.

Drillers Inc. added chrome lignosulfonate to the muds used for drilling all Phase III wells (113A through 116B) with the exception of wells 113B and 116A. Quantities of up to 178 sacks (well 115B) were added to drilling fluids for individual wells. Some of the Phase III muds were hauled offsite for disposal as oil field waste, and some were placed in an on-site mud pit and cement stabilized, east of well pad 114. Chromium may be considered a hazardous waste under the EP toxicity characteristic; however, analysis would be required to determine if the hazardous criteria is met. Mud records from the Phase I re-entry wells and Phase II wells show no hazardous substances added to the muds used to drill these wells.

An on-site water quality laboratory analyzes samples for compliance with NPDES monitoring requirements. This laboratory does not generate hazardous waste as a result of its activities.

4.3.3 Conclusions

Small quantities of hazardous substances have been identified, through a total extraction procedure, in the Dow impoundment, the tar contaminated areas, and the former landfill. The tar has been identified as the probable remains of crude oil fuel tanks belonging to Freeport Sulphur in the early 1900s. Section 101(14)F of CERCLA specifically exempts crude oil and thus exempts the Bryan Mound tar areas from CERCLA requirements. An Uncontrolled Site Hazardous Waste Ranking System analysis was performed on the impoundment, landfill and tarry areas (see Appendix B for worksheets). This analysis identified a low risk of the detected hazardous substances entering migratory pathways or otherwise adversely impacting the environment. Subsequent EP toxicity analysis indicated that the material is not hazardous waste under RCRA.

Dow Chemical disposed approximately 100 lbs. of asbestos in caverns 4 and 5. According to Dow, the effluent from these caverns contained lower quantities of asbestos than the influent water from the Brazos River Diversion Channel. The only possible migratory pathway is through cavern fill, into the brine disposal system; however, it is likely that the asbestos settled to the bottom of the cavern and has no means of migration. Asbestos insulated pipe may have been buried on site by Hooker Chemical; however, none has been found. Chrome lignosulfonate was added to the muds used in drilling six of the eight Phase III wells. The risk of migration has been lowered by stabilization of the mud pit. Preliminary HRS worksheets for these areas are shown in Appendix A.

4.3.4 Recommendations

The brine in caverns 4 and 5 should be sampled for the presence of asbestos, for confirmation of the levels reported by Dow. The mud pit by cavern 114 should be sampled and analyzed for EP toxicity, due to the potential presence of chromium. No further action is required on allegedly buried asbestos insulated pipe, since neither analysis nor site surveys verified its presence.

4.4 ST. JAMES

4.4.1 Past Activity

The land on which the St. James Terminal is located was formerly used as farmland by the Falgoust family. The primary crop was sugar cane.

A number of petroleum related facilities are located around the terminal. To the north is the Capline Tank Farm, built during the early 1960s. To the south are five LOCAP oil storage tanks, constructed in 1981. To the west is a single Exxon oil storage tank, built in 1980. East of the site is a gas plant belonging to Cities Service. This plant has been shut down for approximately two years and is currently being dismantled. The Koch terminal is located north of the Capline Tank Farm. A few oil wells were located in the area, but none were producing at the time of DOE acquisition. Production was for a short period only, with no evidence that any wells were located on DOE property. No past activities resulting in the production or disposal of hazardous waste are known to have been conducted on the site. The area where the docks are located consisted of the river levee and batture prior to DOE aquisition.

4.4.2 DOE Activity

The site functions as a distribution terminal via pipeline for the Bayou Choctaw and Weeks Island SPR sites. Operational activities include the receipt, transmission, and temporary storage of crude oil. These activities have not resulted in generation of hazardous waste.

One major spill of crude oil (6,300 barrels) occurred on the site during 1981; however, it was entirely contained within the tank dikes. No spills from adjacent facilities have entered DOE property. There are no environmentally stressed areas on site. Unusual materials, such as buried metal or drums, were not encountered during construction of the tanks and other site facilities.

The site was issued EPA generator number LA 1890032583 in response to its 1980 Part A RCRA §3005 notification. St. James was reclassified to nonhandler status in June, 1982. No hazardous wastes have been generated or disposed by the St. James Terminal.

4.4.3 Conclusions

No evidence of past hazardous waste disposal or contaminated areas were found at the St. James Terminal. DOE does not generate or dispose hazardous wastes at St. James.

4.4.4 Recommendations

No action is recommended for the St. James Terminal.

4.5 SULPHUR MINES

4.5.1 Past Activity

The Sulphur Mines SPR facility is located on the site occupied by the first Frasch process sulfur mine. Sulfur was mined on site by the Union Sulphur Company from 1896 until 1924, when the sulfur was believed to have been exhausted. Two years later, wells were drilled on the perimeter of the dome and oil was discovered. Union Texas and Pittsburgh Plate Glass began solution mining salt in 1946. Some of the resultant caverns were used for LPG and ethylene storage. Sulfur production was restarted by Union Texas in 1966, and continued for a few years. No evidence of hazardous waste disposal could be identified through interviews with a retired Union Texas employee and examination of the historical records of the site maintained by the Brimstone Museum in Sulphur, Louisiana.

Several effects of sulfur production are still noticeable at the Sulphur Mines site. A large area subsided due to sulfur extraction and remains inundated at the present time. Two barren areas on the SPR site are the former locations of sulfur vats, where the molten sulfur was allowed to harden and stored until shipment. Pieces of elemental sulfur lie on the surface and are intermixed with soil in these areas. The soil is acidic throughout the area, with poor vegetative growth.

4.5.2 DOE Activity

The site is used for the storage of crude oil in solution mined caverns. No new caverns have been constructed by the SPR, although re-entry wells were drilled into the caverns. Four brine disposal wells were drilled and well pads constructed.

No hazardous wastes have been generated or disposed by the SPR at this site. The site was issued EPA generator number LA 8890032586 in 1980, and reclassified to nonhandler status in June, 1982. Mud records of the brine disposal and re-entry wells show Spersene®, a chrome lignosulfonate, added to the muds for re-entry wells to caverns 2 and 6, and brine disposal wells 3 and 4. Muds used for the re-entry wells were disposed off site, with the exception of cavern 7, which used no metals or other hazardous substances. Mud for this well was disposed in trenches adjacent to the well, and was later moved across the road and stabilized by compaction. Muds for the brine disposal wells were left on site and seeded.

Radioactive tracer pellets were added to monitor the gravel packs of brine disposal wells 2, 3, and 4. Several of these were flushed out of well 4 during the course of drilling. Most were recovered, but some remain unaccounted for and may still be present in the mud pit.

4.5.3 Conclusions

The Sulphur Mines SPR site is environmentally stressed, apparently due to past industrial activities. Barren areas are attributed to poor soil permeated by elemental sulfur rather than the presence of hazardous or toxic waste. Small quantities of chromium may be present in the mud pits at brine disposal wells 3 and 4. A potential for migration exists, because the pits are unlined and unstabilized. Radioactive tracer pellets may be present in the brine disposal well 4 mud pit. The tracer pellet isotope is not expected to migrate because the pellets are encapsulated. Preliminary HRS worksheets are shown in Appendix A.

4.5.4 Recommendations

It is recommended that the mud pits at brine disposal wells 3 and 4 be sampled for EP toxicity. It is recommended that a background radiation scan be performed on brine disposal wellpad 4 and that the EP toxicity samples be checked for radioactivity as they are gathered.

4.6 WEEKS ISLAND

4.6.1 Past Activity

Industrial activity began on the Weeks Island site in 1897, when the owners of the land entered into an agreement to mine salt at that location. In 1898, Myles Salt Company, Ltd., was formed. Salt has been mined continuously on the site since that time. In 1930, the Bay Chemical Company obtained a portion of the land. In 1947, both Myles Salt and Bay Chemical conveyed their land to Brine Producers, Inc., which became Myles Salt Company, Inc. In 1948, Morton Salt Company purchased Myles, and has maintained operations on the site since that time. Sodium sulfate, hydrochloric acid, and activated clay have also been manufactured at Weeks Island.

Company-owned housing was maintained on Weeks Island for Morton employees until 1969. The SPR main site area is located on an area formerly occupied by some of these houses.

A Morton Salt representative stated that no hazardous substances are generated by their operation. Morton Chemical does generate toxic wastes, but operates a treatment unit for these wastes. Morton operations do not affect DOE property.

Two dumps have been operated by Morton at Weeks Island. One was operated northeast of the SPR firewater site for dumping off-specification salt. This area has since been covered. An active permitted dump is located between the SPR main site and the firewater area. Neither dump has been used to dispose of hazardous waste. The dumps are not located on DOE property, nor do they affect DOE property, since surface drainage from the dump site does not flow across DOE property. No other waste disposal facilities were operated at Weeks Island, according to Morton.

Oil wells are located on the flanks of the dome, away from DOE property.

4.6.2 DOE Activity

DOE activities at Weeks Island included construction of surface facilities, drilling of two fill holes and a vent shaft, and storage of crude oil in the mine. The main site area was formerly occupied by company housing; the mine shafts were used as such by the previous owners; and the laydown yard, fill area, and firewater area were constructed by SPR in unoccupied wooded areas. The subsurface area has been used only as a salt mine.

This site was issued EPA generator number LA 9890032585 in 1980, and was converted to nonhandler status in 1982. Small quantities of hazardous substances and wastes generated by SPR site activities have been disposed twice. In 1981, twelve drums of PCB-contaminated liquid, five drums of PCB contaminated articles, and a drained and flushed transformer were taken to the Chemical Waste Management facility in Emelle, Alabama by Peterson Maritime Services. In 1983, six drums of waste paint were taken to the Rollins Environmental Services disposal facility in Baton Rouge, Louisiana. No other occurrences of hazardous waste or hazardous substances were found at this site. Drilling mud used on site contained no hazardous substances and was disposed in offsite facilities.

4.6.3 Conclusions

Aside from the two occasions mentioned, no hazardous wastes or substances have been generated by the SPR at the Weeks Island site. Based on the previous status of the DOE-owned areas as company housing, mineshafts, mines, and woods, it is unlikely that any hazardous wastes were located on DOE property. Morton has stated that the two dumps were not used for disposal of hazardous wastes, and these facilities do not affect DOE property. Morton also stated that these were the only two waste disposal facilities at Weeks Island. Examination of aerial photographs support this statement.

4.6.4 Recommendations

No action is recommended for the Weeks Island SPR site.

4.7 WEST HACKBERRY

4.7.1 Past Activity

Little nonagricultural activity took place on the West Hackberry SPR site prior to DOE acquisition. Oil exploration began in 1902, but oil was not discovered until 1928. A large number of producing wells have been drilled on the outskirts of the dome, but none of these are on DOE property. Exploration for sulfur was also conducted, but no sulfur mining took place. An exploratory Frasch well is located between caverns 8 and 9.

In 1934, Olin Matheson, later Olin Corporation, began producing brine for transport off site. This is the only known industrial activity to take place on DOE property. Five of the Olin caverns became Phase I storage caverns for the SPR. The rest of the DOE property was used as pastureland prior to DOE acquisition.

4.7.2 DOE Activity

DOE activities at the West Hackberry site consisted of construction of facilities, storage of crude oil in solution-mined salt caverns, drilling new wells, and solution-mining new caverns. The site was inspected by the Ecology and Environment, Inc. Field Investigation Team (FIT) for the EPA in 1985 as a potential hazardous waste site. A recommendation of no further action was made by the FIT in their Final Strategy Determination Report (Appendix C).

The site was issued EPA generator number LA 2890032582 in 1980, but was reclassified to nonhandler status in 1982. Hazardous wastes and substances have been generated on three occasions. In 1984, approximately two gallons of benzene and 1.5 gallons of benzyl chloride were disposed from the site laboratory by the Chemical Waste Management facility in Carlyss, LA. In 1984, two PCB contaminated transformers were decontaminated by Bath Electric Service, resulting in the generation of thirty-two drums of PCB-contaminated oil and some PCB-contaminated rags. These were taken to the ENSCO facility in El Dorado, Arkansas by CECOS.

In 1985, a transformer was knocked over, resulting in a spill of approximately five gallons of oil containing 13.5 ppm PCB. Although this concentration of PCB is not regulated under TSCA or RCRA, the contaminated soil was placed into six 55-gallon drums to remove all detectable contamination. Bath Electric Service disposed the contaminated soil and the source transformer.

Detailed mud records are available from the Phase II and III wells. No hazardous materials were added to the mud used to drill the Phase II caverns or well 117A. Chrome lignosulfonate mud additive was used to drill well 117B. Frac tanks (portable metal containers) were used when drilling 117B, and the mud was disposed off site. Since some leaching of cavern 117 has been performed, it is unlikely that any drilling fluids remain onsite. Descriptions of the drilling muds used for Phase I and brine disposal wells showed no hazardous substances added to the muds.

A number of stressed areas visible on site are attributed to factors other than hazardous substances. Drill cuttings, with some suspected salt contamination, were disposed between well pads 103 and 109. A single large mud pit, located south of well pad 115, was initially used for the Phase II wells. This system was abandoned and dismantled after a short period of use because it proved unworkable. Frac tanks were subsequently used as mud tanks. Some polyethylene sheeting and wood remnants are visible east and west of well pad 109. Physical inspection of the area southwest of well pad 115 shows a bare area with boards, plywood, polyethylene sheeting, and a plaster-like white material scattered on the surface.

A spill and fire occurred on well pad 6 in 1978. Several areas remain stressed as a result of this incident. A barren area between caverns 7 and 8 represents the remnants of a shell pile from cleanup of the cavern 6 incident. Oil residue found east of cavern 109 remains from the incident. Some of the oil-contaminated soil from the fire was back-filled south of cavern 7 in an area currently functioning as a laydown yard and fire training area. A ring levee around well pad 6, which had filled with oil, was vacuumed up and back-filled. Oil residue still surfaces occasionally north of cavern 6. A spoil area is located between caverns 6 and 8.

A water quality laboratory is maintained on site for the primary purpose of NPDES sampling. This laboratory has generated a small quantity of hazardous waste (previously discussed) on a single occasion.

4.7.3 Conclusions

There are a number of environmentally stressed areas on the West Hackberry site. These areas are attributed to oil and salt contamination, and do not merit investigation for hazardous waste disposal. Aside from three one-time occurrences, (properly handled under RCRA and TSCA), no hazardous waste has been generated by site activities. The chrome lignosulfonate mud additive used in the drilling of well 117B was contained in frac tanks with the cuttings and disposed off site.

4.7.4 Recommendations

No action is recommended for the West Hackberry SPR site.

APPENDIX A

Preliminary Uncontrolled Site Hazardous Waste

Ranking System Worksheets

Facility name: Bayou Choctaw SPR Site

Location: Plaquemine, LA

EPA Region: VI

Person(s) in charge of the facility: J. Hyde

Name of Reviewer: C. Upton Date: 4/30/86

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

Drilling mud disposal area

Scores: S_M = (S_{gw} = S_{sw} = S_a = 0)

S_{FE} = N/A

S_{DC} =

Ground Water Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release (1)	(0) 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern (2)	0 1 (2) 3	2	4	6	
Net Precipitation (3)	0 1 (2) 3	1	2	3	
Permeability of the Unsaturated Zone (4)	0 (1) 2 3	1	1	3	
Physical State (5)	(0) 1 2 3	1	0	3	
Total Route Characteristics Score			7	15	
3 Containment (6)	0 1 2 (3)	1	3	3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence (7)	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity (8)	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score				26	
5 Targets					3.5
Ground Water Use (9)	0 1 2 3	3		9	
Distance to Nearest Well/Population Served (10)	0 4 6 8 10 / 12 16 18 20 / 24 30 32 35 40	1		40	
Total Targets Score				49	
6 If line 1 is 45, multiply 1 x 4 x 5 / If line 1 is 0, multiply 2 x 3 x 4 x 5				57,330	
7 Divide line 6 by 57,330 and multiply by 100	S_{gw} =				

Surface Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release (1)	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain (2)	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall (3)	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water (4)	0 1 2 (3)	2	6	6	
Physical State (5)	(0) 1 2 3	1	0	3	
Total Route Characteristics Score			9	15	
3 Containment (6)	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence (7)	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity (8)	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score				26	
5 Targets					4.5
Surface Water Use (9)	0 1 2 3	3		9	
Distance to a Sensitive Environment (10)	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream (11)	0 4 6 8 10 12 16 18 20 24 30 32 35 40	1		40	
Total Targets Score				55	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5				64,350	
7 Divide line 6 by 64,350 and multiply by 100	S_{sw} =				

Air Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
[1] Observed Release (1)	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line [1] is 0, the S_a = 0. Enter on line [5]. If line [1] is 45, then proceed to line [2].					
[2] Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
[3] Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
[4] Multiply [1] x [2] x [3]			0	35,100	
[5] Divide line [4] by 35,100 and multiply by 100	S_a = 0				

	s	s^2
Groundwater Route Score (S_{gw})		
Surface Water Route Score (S_{sw})		
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		

1.N/A

Fire and Explosion Work Sheet

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Containment	1 3	1		3	7.1
2 Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score				20	
3 Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Total Targets Score				24	
4 Multiply 1 x 2 x 3				1,440	
5 Divide line 4 by 1,440 and multiply by 100	S_{FE} = N/A				

Direct Contact Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Incident (1)	0 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2					
2 Accessibility (2)	0 1 2 3	1	1	3	8.2
3 Containment (3)	0 15	1		15	8.3
4 Waste Characteristics (4) Toxicity	0 1 2 3	5		15	8.4
5 Targets					8.5
Population Within a 1-Mile Radius (5)	0 1 2 3 4 5	4		20	
Distance to a Critical Habitat (6)	0 1 2 3	4	12	12	
Total Targets Score				32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5				21,600	
7 Divide line 6 by 21,600 and multiply by 100			S_{DC} =		

Basis and References: Bayou Choctaw Drilling Mud Area

Groundwater

1. No observed release
2. 60 feet to Shallow Plaquemine Aquifer (CER 3.4.1.2)
3. Approximately 56 inches rain, 48 inches evaporation per year (EIS; and 40 CFR 300, App. A, Fig. 4)
4. Silty Clay (CER 4.1.2)
5. Stabilized solid (CER 4.1.2)
6. Unlined (CER 4.1.3)
7. No data
8. No data
9. No data
10. No data

Surface Water

1. No observed release
2. Slope <3%
3. 1 year 24 hour rainfall approximately 4.5 inches (40 CFR 300, App. A, Fig. 8)
4. <1000 ft to wetlands
5. Stabilized solid (CER 4.1.2)
6. No dike or diversion system
7. No data
8. No data
9. No data
10. <1000 ft to wetland
11. No data

Air

1. No observed incident

Fire and Explosion

1. Site has not been certified or demonstrated to be a fire and explosion threat

Direct Contact

1. No observed incident
2. Guarded, but accessible to site personnel
3. No data
4. No data
5. No data
6. <½ mile to wetlands

References:

CER: CERCLA report
EIS: Environmental Impact Statement
CFR: Code of Federal Regulations

If no reference listed, data obtained by site inspection and/or interview of site personnel.

Facility name: Bayou Choctaw SPR Site

Location: Plaquemine, LA

EPA Region: VI

Person(s) in charge of the facility: J. Hyde

Name of Reviewer: C. Upton

Date: 4/30/86

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

Inactive solution mined cavern (#10)

Scores: S_M = (S_{gw} = S_{sw} = S_a = 0)

S_{FE} = N/A

S_{DC} =

Ground Water Route Work Sheet					
Rating Factor	**Assigned Value (Circle One)**	**Multiplier**	**Score**	**Max. Score**	**Ref. (Section)**
1 Observed Release (1)	0 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern (2)	0 1 2 3	2	4	6	
Net Precipitation (3)	0 1 2 3	1	2	3	
Permeability of the Unsaturated Zone (4)	0 1 2 3	1	1	3	
Physical State (5)	0 1 2 3	1	3	3	
	Total Route Characteristics Score		10	15	
3 Containment (6)	0 1 2 3	1	1	3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence (7)	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity (8)	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			26	
5 Targets					3.5
Ground Water Use (9)	0 1 2 3	3		9	
Distance to Nearest Well/Population Served (10)	0 4 6 8 10 12 16 18 20 24 30 32 35 40	1		40	
	Total Targets Score			49	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5				57,330	
7 Divide line 6 by 57,330 and multiply by 100		S_{gw} =			

Surface Water Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release (1)	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain (2)	0 1 2 3	1		3	
1-yr. 24-hr. Rainfall (3)	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water (4)	0 1 2 (3)	2	6	6	
Physical State (5)	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			12	15	
3 Containment (6)	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence (7)	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity (8)	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score				26	
5 Targets					4.5
Surface Water Use (9)	0 1 2 3	3		9	
Distance to a Sensitive Environment (10)	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream (11)	0 4 6 8 10 / 12 16 18 20 / 24 30 32 35 40	1		40	
Total Targets Score				55	
6 If line 1 is 45, multiply 1 x 4 x 5 / If line 1 is 0, multiply 2 x 3 x 4 x 5				64,350	
7 Divide line 6 by 64,350 and multiply by 100	S_{sw} =				

Air Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
[1] Observed Release (1)	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line [1] is 0, the S_a = 0. Enter on line [5]. If line [1] is 45, then proceed to line [2].					
[2] Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
[3] Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
[4] Multiply [1] x [2] x [3]				35,100	
[5] Divide line [4] by 35,100 and multiply by 100	S_a = 0				

	s	s^2
Groundwater Route Score (S_{gw})		
Surface Water Route Score (S_{sw})		
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		

Fire and Explosion Work Sheet (1)					
Rating Factor	**Assigned Value (Circle One)**	**Multi-plier**	**Score**	**Max. Score**	**Ref. (Section)**
$\boxed{1}$ Containment	1 3	1		3	7.1
$\boxed{2}$ Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
$\boxed{3}$ Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
	Total Targets Score			24	
$\boxed{4}$ Multiply $\boxed{1}$ x $\boxed{2}$ x $\boxed{3}$				1,440	
$\boxed{5}$ Divide line $\boxed{4}$ by 1,440 and multiply by 100	S_{FE} = N/A				

PRELIMINARY

Direct Contact Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Incident (1)	(0) 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2					
2 Accessibility (2)	0 (1) 2 3	1	1	3	8.2
3 Containment (3)	0 (15)	1	15	15	8.3
4 Waste Characteristics Toxicity (4)	0 1 2 3	5		15	8.4
5 Targets					8.5
Population Within a 1-Mile Radius (5)	0 1 2 3 4 5	4		20	
Distance to a Critical Habitat (6)	0 1 2 (3)	4	12	12	
Total Targets Score				32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			0	21,600	
7 Divide line 6 by 21,600 and multiply by 100	S_{DC} = 0				

PRELIMINARY

Basis and References: Bayou Choctaw Cavern 10

Groundwater

1. No observed release
2. 60 feet to Shallow Plaquemine Aquifer (CER 3.4.1.2)
3. Approximately 56 inches of rain per year, 48 inches evaporation (EIS; and 40 CFR 300, App. A, Fig. 4)
4. Silty clay (CER 3.4.1.2)
5. Liquid (CER 4.1.1)
6. Contained in salt dome, but no leachate collection system
7. No data
8. No data
9. No data
10. No data

Surface Water

1. No observed release
2. No data
3. 1 year 24 hour rainfall approximately 4.5 inches (40 CFR 300, App. A, Fig. 8)
4. Distance to East-West Canal <100 ft
5. Liquid (CER 4.1.1)
6. No dike or diversion system
7. No data
8. No data
9. No data
10. <100 feet to wetland
11. No data

Air

1. No observed release

Fire and Explosion

1. Site has not been certified or demonstrated to be an explosion hazard

Direct Contact

1. No observed incident
2. No barrier to on-site personnel, but area is patrolled by guards
3. Accessible via the wellhead valves
4. No data
5. No data
6. <¼ mile to wetlands

References:

CER: CERCLA report
EIS: Environmental Impact Statement
CFR: Code of Federal Regulations

If no reference listed, data obtained by site inspection and/or interview of site personnel.

Facility name: Big Hill SPR Site

Location: Jefferson County, TX

EPA Region: VI

Person(s) in charge of the facility: L. Lehr

Name of Reviewer: C. Upton Date: 5/2/86

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

Wells with potentially contaminated brines.

Scores: S_M = (S_{gw} = S_{sw} = S_a = 0)

S_{FE} = N/A

S_{DC} = 0

Ground Water Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release (1)	(0) 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern (2)	0 1 2 (3)	2	6	6	
Net Precipitation (3)	0 (1) 2 3	1	1	3	
Permeability of the Unsaturated Zone (4)	0 (1) 2 3	1	1	3	
Physical State (5)	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			11	15	
3 Containment (6)	0 (1) 2 3	1	1	3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence (7)	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity (8)	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score				26	
5 Targets					3.5
Ground Water Use (9)	0 1 2 3	3		9	
Distance to Nearest Well/Population Served (10)	0 4 6 8 10 12 16 18 20 24 30 32 35 40	1		40	
Total Targets Score				49	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5				57,330	
7 Divide line 6 by 57,330 and multiply by 100		S_{gw} =			

Surface Water Route Work Sheet					
Rating Factor	**Assigned Value (Circle One)**	**Multi-plier**	**Score**	**Max. Score**	**Ref. (Section)**
1 Observed Release (1)	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain (2)	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall (3)	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water (4)	0 1 (2) 3	2	4	6	
Physical State (5)	0 1 2 (3)	1	3	3	
	Total Route Characteristics Score		10	15	
3 Containment (6)	0 (1) 2 3	1	1	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence (7)	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity (8)	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			26	
5 Targets					4.5
Surface Water Use (9)	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment (10)	0 (1) 2 3	2	2	6	
Population Served/Distance to Water Intake Downstream (11)	0 4 6 8 10 12 16 18 20 24 30 32 35 40	1		40	
	Total Targets Score			55	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5				64,350	
7 Divide line 6 by 64,350 and multiply by 100	S_{sw} =				

PRELIMINARY

Air Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release (1)	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line [1] is 0, the S_a = 0. Enter on line [5]. If line [1] is 45, then proceed to line [2].					
[2] Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
[3] Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
[4] Multiply [1] x [2] x [3]			0	35,100	
[5] Divide line [4] by 35,100 and multiply by 100		S_a = 0			

	S	S^2
Groundwater Route Score (S_{gw})		
Surface Water Route Score (S_{sw})		
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		

Fire and Explosion Work Sheet (1)					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Containment	1 3	1		3	7.1
2 Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score				20	
3 Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Total Targets Score				24	
4 Multiply 1 x 2 x 3				1,440	
5 Divide line 4 by 1,440 and multiply by 100		S_{FE} = N/A			

Direct Contact Work Sheet

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Incident (1)	(0) 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2					
2 Accessibility (2)	0 (1) 2 3	1	1	3	8.2
3 Containment (3)	(0) 15	1	0	15	8.3
4 Waste Characteristics Toxicity (4)	0 1 2 3	5		15	8.4
5 Targets					8.5
Population Within a 1-Mile Radius (5)	0 1 2 3 4 5	4		20	
Distance to a Critical Habitat (6)	(0) 1 2 3	4	4	12	
Total Targets Score				32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			0	21,600	
7 Divide line 6 by 21,600 and multiply by 100		S_{DC} = 0			

Basis and References: Big Hill Wells

Groundwater

1. No observed release
2. Groundwater depth of 6-10 feet (EIS)
3. 52 inches mean annual evaporation, 44 inches mean annual precipitation (40 CFR 300, App. A, Fig. 4; and EIS)
4. Clay and silty loam (CER 3.4.2.2)
5. Liquid (CER 4.2.2)
6. Contained in salt formation, but no leachate collection system (CER 4.2.3)
7. No data
8. No data
9. No data
10. No data

Surface Water

1. No observed release
2. Slope <3%
3. 1 year 24 hour rainfall 4 inches (40 CFR 300, App. A, Fig. 8)
4. Approximately 1 mile to wetlands (CER 3.4.2.1)
5. Liquid (CER 4.2.2)
6. No diversion system, but only means of escape would be through wellhead severance (CER 4.2.3)
7. No data
8. No data
9. Pond used for rice field irrigation (CER 3.4.2.3)
10. Approximately 1 mile to wetlands (CER 3.4.2.1)
11. No data

Air

1. No observed release

Fire and Explosion

1. Not certified or demonstrated fire or explosion hazard

Direct Contact

1. No observed incident
2. No barrier to site personnel, but guards patrol
3. Not easily contacted
4. No data
5. No data
6. Approximately 1 mile to wetlands (CER 3.4.2.1)

References:

CER: CERCLA
EIS: Environmental Impact Statement
CFR: Code of Federal Regulations

If no reference listed, data obtained by site inspections and/or interview of site personnel.

Facility name: Big Hill SPR Site

Location: Jefferson County, Texas

EPA Region: VI

Person(s) in charge of the facility: L. Lehr

Name of Reviewer: C. Upton Date: 4/30/86

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

Drill Cuttings disposal ponds

Scores: S_M = 0 (S_{gw} = 0 S_{sw} = 0 S_a = 0)

S_{FE} = N/A

S_{DC} =

Ground Water Route Work Sheet

	Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1	Observed Release (1)	(0) 45	1	0	45	3.1
	If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2	Route Characteristics					3.2
	Depth to Aquifer of Concern (2)	0 1 2 (3)	2	6	6	
	Net Precipitation (3)	0 (1) 2 3	1	1	3	
	Permeability of the Unsaturated Zone (4)	0 (1) 2 3	1	1	3	
	Physical State (5)	0 1 2 (3)	1	3	3	
		Total Route Characteristics Score		11	15	
3	Containment (6)	(0) 1 2 3	1	0	3	3.3
4	Waste Characteristics					3.4
	Toxicity/Persistence (7)	0 3 6 9 12 15 18	1		18	
	Hazardous Waste Quantity (8)	0 1 2 3 4 5 6 7 8	1		8	
		Total Waste Characteristics Score			26	
5	Targets					3.5
	Ground Water Use (9)	0 1 2 3	3		9	
	Distance to Nearest Well/Population Served (10)	0 4 6 8 10 12 16 18 20 24 30 32 35 40	1		40	
		Total Targets Score			49	
6	If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			0	57,330	
7	Divide line 6 by 57,330 and multiply by 100		S_{gw} =	0		

Surface Water Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release (1)	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain (2)	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall (3)	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water (4)	0 1 (2) 3	2	4	6	
Physical State (5)	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			10	15	
3 Containment (6)	(0) 1 2 3	1	0	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence (7)	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity (8)	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score				26	
5 Targets					4.5
Surface Water Use (9)	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment (10)	0 (1) 2 3	2	2	6	
Population Served/Distance to Water Intake Downstream (11)	0 4 6 8 10 / 12 16 18 20 / 24 30 32 35 40	1		40	
Total Targets Score				55	
6 If line 1 is 45, multiply 1 x 4 x 5. If line 1 is 0, multiply 2 x 3 x 4 x 5			0	64,350	
7 Divide line 6 by 64,350 and multiply by 100	S_{sw} = 0				

Air Route Work Sheet					
Rating Factor	**Assigned Value (Circle One)**	**Multiplier**	**Score**	**Max. Score**	**Ref. (Section)**
1 Observed Release (1)	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line 1 is 0, the S_a = 0. Enter on line 5 . If line 1 is 45, then proceed to line 2 .					
2 Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
3 Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
4 Multiply 1 x 2 x 3			0	35,100	
5 Divide line 4 by 35,100 and multiply by 100		S_a = 0			

	S	S^2
Groundwater Route Score (S_{gw})	0	0
Surface Water Route Score (S_{sw})	0	0
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		0
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		0
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} \,/\, 1.73 = S_M =$		0

N/A (1)

Fire and Explosion Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Containment	1 3	1		3	7.1
2 Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score				20	
3 Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Total Targets Score				24	
4 Multiply 1 x 2 x 3				1,440	
5 Divide line 4 by 1,440 and multiply by 100			S_{FE} = N/A		

Direct Contact Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Incident (1)	(0) 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2					
2 Accessibility (2)	0 (1) 2 3	1	1	3	8.2
3 Containment (3)	0 (15)	1	15	15	8.3
4 Waste Characteristics Toxicity (4)	0 1 2 3	5		15	8.4
5 Targets					8.5
Population Within a 1-Mile Radius (5)	0 1 2 3 4 5	4		20	
Distance to a Critical Habitat (6)	0 (1) 2 3	4	4	12	
Total Targets Score				32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5				21,600	
7 Divide line 6 by 21,600 and multiply by 100	S_{DC} =				

Basis and References: Big Hill Drill Cuttings Ponds

Groundwater

1. No observed release
2. Groundwater depth of 6-10 feet (EIS)
3. 52 inches mean annual evaporation, 44 inches mean annual precipitation (EIS; and 40 CFR 300, App. A, Fig. 4)
4. Clay and silty loam (CER 3.4.2.2)
5. Sludge consistancy
6. Liner, with leachate collection system
7. No data
8. No data
9. No data
10. No data

Surface Water

1. No observed release
2. Slope <3%
3. 1 year 24 hour rainfall 4 inches (40 CFR 300, App. A, Fig. 8)
4. Approximately 1 mile to wetlands (CER 3.4.2.1)
5. Sludge consistancy
6. Diked, with adequate freeboard
7. No data
8. No data
9. Pond used for rice field irrigation (CER 3.4.2.3)
10. Approximately 1 mile to wetlands (CER 3.4.2.1)
11. No data

Air

1. No observed release

Fire and Explosion

1. Not certified or demonstrated fire or explosion hazard

Direct Contact

1. No observed incident
2. Guarded, but no fence around ponds to prevent entry by site personnel
3. No cover
4. No data
5. No data
6. Approximately 1 mile to wetlands (CER 3.4.2.1)

References:

CER: CERCLA Report
EIS: Environmental Impact Statement
CFR: Code of Federal Regulations

If no reference listed, data obtained by site inspection and/or interview of site personnel.

Facility name: Big Hill SPR Site

Location: Jefferson County, TX

EPA Region: VI

Person(s) in charge of the facility: L. Lehr

Name of Reviewer: C. Upton Date: 4/30/86

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

Fresh water drill cuttings disposal area

Scores: S_M = (S_{gw} = S_{sw} = S_a = 0)

S_{FE} = N/A

S_{DC} =

Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release (1)	(0) 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern (2)	0 1 2 (3)	2	6	6	
Net Precipitation (3)	0 (1) 2 3	1	1	3	
Permeability of the Unsaturated Zone (4)	0 (1) 2 3	1	1	3	
Physical State (5)	(0) 1 2 3	1	0	3	
	Total Route Characteristics Score		8	15	
3 Containment (6)	0 1 2 (3)	1	3	3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence (7)	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity (8)	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			26	
5 Targets					3.5
Ground Water Use (9)	0 1 2 3	3		9	
Distance to Nearest Well/Population Served (10)	0 4 6 8 10 12 16 18 20 24 30 32 35 40	1		40	
	Total Targets Score			49	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5				57,330	
7 Divide line 6 by 57,330 and multiply by 100	S_{gw} =				

Surface Water Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release (1)	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain (2)	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall (3)	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water (4)	0 1 2 (3)	2	6	6	
Physical State (5)	(0) 1 2 3	1	0	3	
	Total Route Characteristics Score		9	15	
3 Containment (6)	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence (7)	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity (8)	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			26	
5 Targets					4.5
Surface Water Use (9)	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment (10)	0 (1) 2 3	2	2	6	
Population Served/Distance to Water Intake Downstream (11)	0 4 6 8 10 12 16 18 20 24 30 32 35 40	1		40	
	Total Targets Score			55	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5				64,350	
7 Divide line 6 by 64,350 and multiply by 100		S_{sw} =			

PRELIMINARY

Air Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release (1)	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line 1 is 0, the S_a = 0. Enter on line 5. If line 1 is 45, then proceed to line 2.					
2 Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
3 Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
4 Multiply 1 x 2 x 3			0	35,100	
5 Divide line 4 by 35,100 and multiply by 100	S_a = 0				

	S	S^2
Groundwater Route Score (S_{gw})		
Surface Water Route Score (S_{sw})		
Air Route Score (S_a)	0	0
$S^2_{gw} + S^2_{sw} + S^2_a$		
$\sqrt{S^2_{gw} + S^2_{sw} + S^2_a}$		
$\sqrt{S^2_{gw} + S^2_{sw} + S^2_a} / 1.73 = S_M =$		

Fire and Explosion Work Sheet (1)					
Rating Factor	**Assigned Value (Circle One)**	**Multi-plier**	**Score**	**Max. Score**	**Ref. (Section)**
1 Containment	1 3	1		3	7.1
2 Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
3 Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
	Total Targets Score			24	
4 Multiply 1 x 2 x 3				1,440	
5 Divide line 4 by 1,440 and multiply by 100	S_{FE} = N/A				

PRELIMINARY

Direct Contact Work Sheet					
Rating Factor	**Assigned Value (Circle One)**	**Multiplier**	**Score**	**Max. Score**	**Ref. (Section)**
1 Observed Incident (1)	0 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2					
2 Accessibility (2)	0 (1) 2 3	1	1	3	8.2
3 Containment (3)	0 15	1		15	8.3
4 Waste Characteristics Toxicity (4)	0 1 2 3	5		15	8.4
5 Targets					8.5
Population Within a 1-Mile Radius (5)	0 1 2 3 4 5	4		20	
Distance to a Critical Habitat (6)	0 (1) 2 3	4	4	12	
	Total Targets Score			32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5				21,600	
7 Divide line 6 by 21,600 and multiply by 100	S_{DC} =				

Basis and Reference: Big Hill Freshwater Ponds

Groundwater

1. No observed release
2. Groundwater depth of 6-10 feet (EIS)
3. 52 inches evaporation, 44 inches precipitation (EIS; and 40 CFR 300, App. A., Fig. 4)
4. Clay and silty loam (CER 3.4.2.2)
5. Stabilized solid
6. Unlined
7. No data
8. No data
9. No data
10. No data

Surface Water

1. No observed release
2. Slope <3%
3. 1 year 24 hour rainfall: 4 inches (40 CFR 300, App. A, Fig. 8)
4. Approximately 1 mile to wetlands (CER 3.4.2.1)
5. Stabilized solid
6. No dike
7. No data
8. No data
9. Pond used for rice field irrigation (CER 3.4.2.3)
10. Approximately 1 mile to wetlands (CER 3.4.2.1)
11. No data

Air

1. No observed release

Fire and Explosion

1. Not applicable - not certified or demonstrated fire hazard

Direct Contact

1. No observed incident
2. No barrier to on-site personnel, but guards patrol site
3. No data
4. No data
5. No data
6. Approximately 1 mile to wetlands (CER 3.4.2.1)

References:

CER: CERCLA report
EIS: Environmental Impact Statement
CFR: Code of Federal Regulations

If no reference listed, data obtained by site inspections and/or interview of site personnel.

Facility name: Bryan Mound SPR Site

Location: Freeport, TX

EPA Region: VI

Person(s) in charge of the facility: N. Packard

Name of Reviewer: C. Upton **Date:** 5/2/86

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

Caverns 4 and 5, suspected asbestos contamination

Scores: S_M = 1.78 (S_{gw} = 0 S_{sw} = 3.08 S_a = 0)

S_{FE} = N/A

S_{DC} = 13.9

Ground Water Route Work Sheet						
Rating Factor		**Assigned Value (Circle One)**	**Multi-plier**	**Score**	**Max. Score**	**Ref. (Section)**
1 Observed Release	(1)	(0) 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.						
2 Route Characteristics						3.2
Depth to Aquifer of Concern	(2)	0 1 2 (3)	2	6	6	
Net Precipitation	(3)	0 (1) 2 3	1	1	3	
Permeability of the Unsaturated Zone	(4)	0 (1) 2 3	1	1	3	
Physical State	(5)	0 1 (2) 3	1	2	3	
Total Route Characteristics Score				10	15	
3 Containment	(6)	0 (1) 2 3	1	1	3	3.3
4 Waste Characteristics						3.4
Toxicity/Persistence	(7)	0 3 6 9 12 (15) 18	1	15	18	
Hazardous Waste Quantity	(8)	(0) 1 2 3 4 5 6 7 8	1	0	8	
Total Waste Characteristics Score				15	26	
5 Targets						3.5
Ground Water Use	(9)	(0) 1 2 3	3	0	9	
Distance to Nearest Well/Population Served	(10)	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score				0	49	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5				0	57,330	
7 Divide line 6 by 57,330 and multiply by 100		S_{gw} = 0				

Surface Water Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release (1)	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain (2)	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall (3)	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water (4)	0 1 2 (3)	2	6	6	
Physical State (5)	0 1 (2) 3	1	2	3	
Total Route Characteristics Score			11	15	
3 Containment (6)	0 (1) 2 3	1	1	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence (7)	0 3 6 9 12 (15) 18	1	15	18	
Hazardous Waste Quantity (8)	(0) 1 2 3 4 5 6 7 8	1	0	8	
Total Waste Characteristics Score			15	26	
5 Targets					4.5
Surface Water Use (9)	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment (10)	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream (11)	(0) 4 6 8 10 / 12 16 18 20 / 24 30 32 35 40	1	0	40	
Total Targets Score			12	55	
6 If line 1 is 45, multiply 1 x 4 x 5. If line 1 is 0, multiply 2 x 3 x 4 x 5			1980	64,350	
7 Divide line 6 by 64,350 and multiply by 100			S_{sw} = 3.08		

Air Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release (1)	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line 1 is 0, the S_a = 0. Enter on line 5. If line 1 is 45, then proceed to line 2.					
2 Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
3 Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
4 Multiply 1 x 2 x 3			0	35,100	
5 Divide line 4 by 35,100 and multiply by 100		S_a = 0			

	S	S^2
Groundwater Route Score (S_{gw})	0	0
Surface Water Route Score (S_{sw})	3.08	9.49
Air Route Score (S_a)	0	0
$S^2_{gw} + S^2_{sw} + S^2_a$		9.49
$\sqrt{S^2_{gw} + S^2_{sw} + S^2_a}$		3.08
$\sqrt{S^2_{gw} + S^2_{sw} + S^2_a} / 1.73 = S_M =$		1.78

Fire and Explosion Work Sheet (1)					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Containment	1 3	1		3	7.1
2 Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
3 Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
	Total Targets Score			24	
4 Multiply 1 x 2 x 3				1,440	
5 Divide line 4 by 1,440 and multiply by 100	S_{FE} = N/A				

PRELIMINARY

Direct Contact Work Sheet

Rating Factor		Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Incident	(1)	(0) 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2						
2 Accessibility	(2)	0 (1) 2 3	1	1	3	8.2
3 Containment	(3)	0 (15)	1	15	15	8.3
4 Waste Characteristics Toxicity	(4)	0 1 (2) 3	5	10	15	8.4
5 Targets						8.5
Population Within a 1-Mile Radius	(5)	0 1 (2) 3 4 5	4	8	20	
Distance to a Critical Habitat	(6)	0 1 2 (3)	4	12	12	
Total Targets Score				20	32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5				3000	21,600	
7 Divide line 6 by 21,600 and multiply by 100				S_{DC} = 13.9		

Basis and References: Bryan Mound Caverns 4 and 5

Groundwater

1. No observed release
2. Depth to groundwater 10 to 15 feet (CER, App. A Note 1)
3. Mean evaporation 54 inches, mean rainfall 46 inches (40 CFR 300, App. A, Figs. 4 & 5)
4. Silty Clay (CER 3.4.3.2)
5. Powdered material, suspended in brine (CER 4.3.1)
6. Contained in salt formation, but no leachate system (CER 4.3.3)
7. Toxicity moderate, highly persistant (Sax)
8. Approximately 100 lbs. (CER 4.3.1)
9. Saline groundwater (CER, App. A, note 9)
10. Groundwater not used (CER, App. A, note 10)

Surface Water

1. No observed release
2. Slopes are <3%
3. 1 year 4 hour rainfall approximately 4 inches (40 CFR 300, App. A, Fig. 8)
4. <1000 ft to Blue Lake
5. Powdered material, suspended in brine (CER 4.3.1)
6. Only means of escape is through the brine disposal system (CER 4.3.3)
7. Moderate toxicity, highly persistant (Sax)
8. Approximately 100 lbs (CER 4.3.1)
9. Some fishing in Blue Lake
10. Site surrounded by wetlands (CER, App. A, note 15)
11. No intakes in Blue Lake

Air

1. No observed release

Fire and Explosion

1. The site is neither a certified nor demonstrated fire hazard

Direct Contact

1. No observed incident
2. The brine pond is accessible to site personnel, but guards patrol site
3. No containment offered by brine pond
4. Moderate toxicity (Sax)
5. Over 100 people employed at the site and surrounding facilities (CER, App. A, note 10)
6. Site is surrounded by wetlands (CER, App.A, note 15)

References:

CER - CERCLA Report
Sax - N.I. Sax, "Dangerous Properties of Industrial Materials", 5th ed.
CFR - Code of Federal Regulations

If no reference listed, data obtained by site inspection and/or interview of site personnel.

Facility name: Bryan Mound

Location: Freeport, TX

EPA Region: VI

Person(s) in charge of the facility: N. Packard

Name of Reviewer: C. Upton Date: 5/2/86

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

Mud disposal pit

Scores: S_M = (S_{gw} = 0 S_{sw} = S_a = 0)

S_{FE} = N/A

S_{DC} =

Ground Water Route Work Sheet

Rating Factor		Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	(1)	(0) 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.						
2 Route Characteristics						3.2
Depth to Aquifer of Concern	(2)	0 1 2 (3)	2	6	6	
Net Precipitation	(3)	0 (1) 2 3	1	1	3	
Permeability of the Unsaturated Zone	(4)	0 (1) 2 3	1	1	3	
Physical State	(5)	(0) 1 2 3	1	0	3	
		Total Route Characteristics Score		8	15	
3 Containment	(6)	0 1 2 (3)	1	3	3	3.3
4 Waste Characteristics						3.4
Toxicity/Persistence	(7)	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity	(8)	0 1 2 3 4 5 6 7 8	1		8	
		Total Waste Characteristics Score			26	
5 Targets						3.5
Ground Water Use	(9)	(0) 1 2 3	3	0	9	
Distance to Nearest Well/Population Served	(10)	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
		Total Targets Score		0	49	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5				0	57,330	
7 Divide line 6 by 57,330 and multiply by 100			S_{gw} =	0		

PRELIMINARY

Surface Water Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release (1)	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain (2)	0 1 2 3	1		3	
1-yr. 24-hr. Rainfall (3)	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water (4)	0 1 2 (3)	2	6	6	
Physical State (5)	(0) 1 2 3	1	0	3	
	Total Route Characteristics Score			15	
3 Containment (6)	0 1 (2) 3	1	2	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence (7)	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity (8)	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			26	
5 Targets					4.5
Surface Water Use (9)	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment (10)	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream (11)	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
	Total Targets Score		12	55	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5				64,350	
7 Divide line 6 by 64,350 and multiply by 100		S_{sw} =			

Air Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release (1)	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line 1 is 0, the S_a = 0. Enter on line 5. If line 1 is 45, then proceed to line 2.					
2 Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
3 Targets					5.3
Population Within 4-Mile Radius	} 0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
4 Multiply 1 x 2 x 3			0	35,100	
5 Divide line 4 by 35,100 and multiply by 100		S_a = 0			

	s	s^2
Groundwater Route Score (S_{gw})	0	0
Surface Water Route Score (S_{sw})		
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		

Fire and Explosion Work Sheet (1)					
Rating Factor	**Assigned Value (Circle One)**	**Multiplier**	**Score**	**Max. Score**	**Ref. (Section)**
1 Containment	1 3	1		3	7.1
2 Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
3 Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
	Total Targets Score			24	
4 Multiply 1 x 2 x 3				1,440	
5 Divide line 4 by 1,440 and multiply by 100		S_{FE} = N/A			

Direct Contact Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Incident (1)	(0) 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2					
2 Accessibility (2)	0 (1) 2 3	1	1	3	8.2
3 Containment (3)	0 15	1		15	8.3
4 Waste Characteristics Toxicity (4)	0 1 2 3	5		15	8.4
5 Targets					8.5
Population Within a 1-Mile Radius (5)	0 1 (2) 3 4 5	4	8	20	
Distance to a Critical Habitat (6)	0 1 2 (3)	4	12	12	
Total Targets Score			20	32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5				21,600	
7 Divide line 6 by 21,600 and multiply by 100	S_{DC} =				

Basis and References: Bryan Mound Mud Pit

Groundwater

1. No observed release
2. Depth to groundwater is 10 to 15 feet (CER, App. A, note 1)
3. Mean evaporation 54 inches, mean rainfall 46 inches (40 CFR 300, App. A, Figs. 4 & 5)
4. Based on silty clay (CER 3.4.3.2)
5. Stabilized solid (CER 4.3.3)
6. Unlined
7. No data
8. No data
9. Saline groundwater (CER, App. A, note 9)
10. Groundwater not used (CER, App. A, note 10)

Surface Water

1. No observed release
2. No data
3. 1 year 24 hour rainfall approximately 4 inches (40 CFR 300, App. A, Fig. 8)
4. <1000 ft to Mud Lake
5. Stabilized solid (CER 4.3.3)
6. Diked, but dikes eroded
7. No data
8. No data
9. Some fishing in Mud Lake (CER, App. A, note 14)
10. Site surrounded by wetlands (CER, App. A, note 15)
11. No intakes in Mud Lake or chute connecting it to the Intracoastal Waterway (CER, App. A, note 16)

Air

1. No observed release

Fire and Explosion

1. The site has neither been certified nor has been demonstrated to be a fire or explosion hazard

Direct Contact

1. No observed incident
2. Area accessible to site personnel, but is patrolled
3. No data
4. No data
5. Over 100 people employed at site and surrounding facilities (CER, App. A, note 20)
6. Site is surrounded by wetlands (CER, App. A, note 15)

References:

CER - CERCLA Report
CFR - Code of Federal Regulations

If no reference listed, data obtained by site inspection and/or interview of site personnel.

Facility name: Sulphur Mines SPR Site

Location: Sulphur, LA

EPA Region: VI

Person(s) in charge of the facility: A. Fruge

Name of Reviewer: C. Upton Date: 5/2/86

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

Mud pits

Scores: S_M = (S_{gw} = S_{sw} = S_a = 0)

S_{FE} = N/A

S_{DC} =

Ground Water Route Work Sheet

Rating Factor		Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release	(1)	(0) 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.						
2 Route Characteristics						3.2
Depth to Aquifer of Concern	(2)	0 1 2 (3)	2	6	6	
Net Precipitation	(3)	0 (1) 2 3	1	1	3	
Permeability of the Unsaturated Zone	(4)	0 (1) 2 3	1	1	3	
Physical State	(5)	0 (1) 2 3	1	1	3	
		Total Route Characteristics Score		9	15	
3 Containment	(6)	0 1 2 (3)	1	3	3	3.3
4 Waste Characteristics						3.4
Toxicity/Persistence	(7)	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity	(8)	0 1 2 3 4 5 6 7 8	1		8	
		Total Waste Characteristics Score			26	
5 Targets						3.5
Ground Water Use	(9)	0 1 2 3	3		9	
Distance to Nearest Well/Population Served	(10)	0 4 6 8 10 12 16 18 20 24 30 32 35 40	1		40	
		Total Targets Score			49	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5					57,330	
7 Divide line 6 by 57,330 and multiply by 100		S_{gw} =				

Surface Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release (1)	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain (2)	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall (3)	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water (4)	0 1 (2) 3	2	4	6	
Physical State (5)	0 (1) 2 3	1	1	3	
	Total Route Characteristics Score		8	15	
3 Containment (6)	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence (7)	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity (8)	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			26	
5 Targets					4.5
Surface Water Use (9)	0 1 2 3	3		9	
Distance to a Sensitive Environment (10)	0 (1) 2 3	2	2	6	
Population Served/Distance to Water Intake Downstream (11)	0 4 6 8 10 / 12 16 18 20 / 24 30 32 35 40	1		40	
	Total Targets Score			55	
6 If line 1 is 45, multiply 1 x 4 x 5. If line 1 is 0, multiply 2 x 3 x 4 x 5				64,350	
7 Divide line 6 by 64,350 and multiply by 100	S_{sw} =				

Air Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release (1)	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line 1 is 0, the S_a = 0. Enter on line 5 . If line 1 is 45, then proceed to line 2 .					
2 Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
3 Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
4 Multiply 1 x 2 x 3			0	35,100	
5 Divide line 4 by 35,100 and multiply by 100			S_a = 0		

	s	s^2
Groundwater Route Score (S_{gw})		
Surface Water Route Score (S_{sw})		
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		

Fire and Explosion Work Sheet (1)

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Containment	1 3	1		3	7.1
2 Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
3 Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
	Total Targets Score			24	
4 Multiply 1 x 2 x 3				1,440	
5 Divide line 4 by 1,440 and multiply by 100		S_{FE} = N/A			

Direct Contact Work Sheet

Rating Factor		Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Incident	(1)	(0) 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2						
2 Accessibility	(2)	0 1 2 (3)	1	3	3	8.2
3 Containment	(3)	0 15	1		15	8.3
4 Waste Characteristics Toxicity	(4)	0 1 2 3	5		15	8.4
5 Targets						8.5
Population Within a 1-Mile Radius	(5)	0 1 2 3 4 5	4		20	
Distance to a Critical Habitat	(6)	0 (1) 2 3	4	4	12	
Total Targets Score					32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5					21,600	
7 Divide line 6 by 21,600 and multiply by 100		S_{DC} =				

Basis and References: Sulphur Mines Mud Pits

Groundwater

1. No observed release
2. No data for shallow aquifer, Chicot Aquifer is at -65 ft. so assume worst case (CER 3.4.5.3)
3. Annual precipitation 55 inches, annual evaporation 51 inches (EIS; and 40 CFR 300, App. A, Fig. 4)
4. Silty Clay (CER 3.4.5.2)
5. Unstabilized solid (CER 4.5.3)
6. Unlined (CER 4.5.3)
7. No data
8. No data
9. No data
10. No data

Surface Water

1. No observed release
2. Slope <3%
3. 1 year 24 hour rainfall over 4 inches (40 CFR 300, App. A, Fig. 8)
4. Approximately 4000 feet to Bayou Chopique
5. Unstabilized Solid (CER 4.5.3)
6. No diversion system, not adequately covered
7. No data
8. No data
9. No data
10. Approximately 4000 feet to Bayou Chopique
11. No data

Air

1. No observed release

Fire and Explosion

1. Not a certified or demonstrated fire or explosion hazard

Direct Contact

1. No observed incident
2. No fence, area periodically patrolled
3. No data
4. No data
5. No data
6. Approximately 4000 feet to Bayou Chopique (wetland)

References:

CER - CERCLA report
EIS - Environmental Impact Statement
CFR - Code of Federal Regulations

If no reference listed, data obtained by site inspection and/or interview of site personnel.

APPENDIX B

Bryan Mound Uncontrolled Site Hazardous Waste

Ranking System Worksheets

Facility name: Bryan Mound SPR Facility

Location: Freeport, Texas

EPA Region: VI

Person(s) in charge of the facility: Neil Packard

Name of Reviewer: ______ Date: ______

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

Abandoned Dow Impoundment previously owned and operated by DOW Chemical Company for brine surge in their halite solution mining operation. See attached worksheets for footnotes and further details.

Scores: $S_M = 1.98$ ($S_{gw} = 0.69$ $S_{sw} = 3.36$ $S_a = 0$)

$S_{FE} =$ N/A

$S_{DC} = 8.33$

Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern (1)*	0 1 2 (3)	2	6	6	
Net Precipitation (2)	0 (1) 2 3	1	1	3	
Permeability of the Unsaturated Zone (3)	0 (1) 2 3	1	1	3	
Physical State (4)	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			11	15	
3 Containment (5)	0 1 (2) 3	1	2	3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence (6,7)	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity (8)	(0) 1 2 3 4 5 6 7 8	1	0	8	
Total Waste Characteristics Score			18	26	
5 Targets					3.5
Ground Water Use (9)	(0) 1 2 3	3	0	9	
Distance to Nearest Well/Population Served (10)	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			1	49	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			396	57,330	
7 Divide line 6 by 57,330 and multiply by 100		S_{gw} =	0.69		

*See footnotes for typed parenthetical numbers.

Impoundment

Surface Water Route Work Sheet					
Rating Factor	**Assigned Value (Circle One)**	**Multi-plier**	**Score**	**Max. Score**	**Ref. (Section)**
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain (11, 12)	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall (13)	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water (14)	0 1 (2) 3	2	4	6	
Physical State (4)	0 1 2 (3)	1	3	3	
	Total Route Characteristics Score		10	15	
3 Containment (5)	0 (1) 2 3	1	1	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence (6,7)	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity (8)	(0) 1 2 3 4 5 6 7 8	1	0	8	
	Total Waste Characteristics Score		18	26	
5 Targets					4.5
Surface Water Use (14)	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment (15)	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream (16)	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
	Total Targets Score		12	55	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			2,160	64,350	
7 Divide line 6 by 64,350 and multiply by 100		S_{sw} = 3.36			

Air Route Work Sheet					
Rating Factor	**Assigned Value (Circle One)**	**Multi-plier**	**Score**	**Max. Score**	**Ref. (Section)**
[1] Observed Release	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line [1] is 0, the S_a = 0. Enter on line [5]. If line [1] is 45, then proceed to line [2].					
[2] Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
[3] Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
[4] Multiply [1] x [2] x [3]				35,100	
[5] Divide line [4] by 35,100 and multiply by 100	S_a = 0				

	s	s^2
Groundwater Route Score (S_{gw})	0.69	0.48
Surface Water Route Score (S_{sw})	3.36	11.29
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		11.77
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		3.43
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		1.98

Fire and Explosion Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Containment	1 3	1		3	7.1
2 Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
3 Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
	Total Targets Score			24	
4 Multiply 1 x 2 x 3				1,440	
5 Divide line 4 by 1,440 and multiply by 100		S_{FE} = N/A (17)			

Direct Contact Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Incident	(0) 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2					
2 Accessibility (18)	(0) 1 2 3	1	1	3	8.2
3 Containment (19)	0 (15)	1	15	15	8.3
4 Waste Characteristics Toxicity (6)	0 1 2 (3)	5	15	15	8.4
5 Targets					8.5
Population Within a 1-Mile Radius (20)	0 1 (2) 3 4 5	4	8	20	
Distance to a Critical Habitat (21)	(0) 1 2 3	4	0	12	
Total Targets Score			8	32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			1,800	21,600	
7 Divide line 6 by 21,600 and multiply by 100			S_{DC} = 8.33		

Facility name: Bryan Mound SPR Facility

Location: Freeport, Texas

EPA Region: VI

Person(s) in charge of the facility: Neil Packard

Name of Reviewer: ______ Date: ______

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

South Tar Pit abandoned at this facility prior to purchase by DOE. Tar is believed to be weathered petroleum products. See attached worksheets and footnotes for further details.

Scores: $S_M = 3.83$ ($S_{gw} = 1.04$ $S_{sw} = 6.55$ $S_a = 0$)

S_{FE} = N/A

S_{DC} = 8.33

Ground Water Route Work Sheet					
Rating Factor	**Assigned Value (Circle One)**	**Multi-plier**	**Score**	**Max. Score**	**Ref. (Section)**
1 Observed Release	(0) 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern (1)*	0 1 2 (3)	2	6	6	
Net Precipitation (2)	0 (1) 2 3	1	1	3	
Permeability of the Unsaturated Zone (3)	0 (1) 2 3	1	1	3	
Physical State (4)	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			11	15	
3 Containment (22)	0 1 2 (3)	1	3	3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence (23,7)	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity (24)	(0) 1 2 3 4 5 6 7 8	1	0	8	
Total Waste Characteristics Score			18	26	
5 Targets					3.5
Ground Water Use (9)	(0) 1 2 3	3	0	9	
Distance to Nearest Well/Population Served (10)	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			1	49	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			594	57,330	
7 Divide line 6 by 57,330 and multiply by 100			S_{gw} = 1.04		

*See footnotes for typed parenthetical numbers.

South Tar Pit

Surface Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain (11,25)	0 (1) 2 3	1	1	3	
1-yr. 24-hr. Rainfall (13)	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water (25)	0 1 2 (3)	2	6	6	
Physical State (4)	0 1 2 (3)	1	3	3	
	Total Route Characteristics Score		13	15	
3 Containment (22)	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence (23,7)	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity (24)	(0) 1 2 3 4 5 6 7 8	1	0	8	
	Total Waste Characteristics Score		18	26	
5 Targets					4.5
Surface Water Use (26)	(0) 1 2 3	3	0	9	
Distance to a Sensitive Environment (15)	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream (26)	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
	Total Targets Score		6	55	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			4,212	64,350	
7 Divide line 6 by 64,350 and multiply by 100			S_{sw} = 6.55		

Air Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line 1 is 0, the S_a = 0. Enter on line 5. If line 1 is 45, then proceed to line 2.					
2 Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1. 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
3 Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
4 Multiply 1 x 2 x 3				35,100	
5 Divide line 4 by 35,100 and multiply by 100		S_a =	0		

	s	s^2
Groundwater Route Score (S_{gw})	1.04	1.08
Surface Water Route Score (S_{sw})	6.55	42.90
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		43.98
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		6.63
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		3.83

South Tar Pit

Fire and Explosion Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Containment	1 3	1		3	7.1
2 Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
3 Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
	Total Targets Score			24	
4 Multiply 1 x 2 x 3				1,440	
5 Divide line 4 by 1,440 and multiply by 100		S_{FE} = N/A (17)			

South Tar Pit

Direct Contact Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Incident	(0) 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2					
2 Accessibility (18)	(0) 1 2 3	1	1	3	8.2
3 Containment (22)	0 (15)	1	15	15	8.3
4 Waste Characteristics Toxicity (23)	0 1 2 (3)	5	15	15	8.4
5 Targets					8.5
Population Within a 1-Mile Radius (20)	0 1 (2) 3 4 5	4	8	20	
Distance to a Critical Habitat (21)	(0) 1 2 3	4	0	12	
	Total Targets Score		8	32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			1,800	21,600	
7 Divide line 6 by 21,600 and multiply by 100	S_{DC} = 8.33				

Facility name: Bryan Mound SPR Facility

Location: Freeport, Texas

EPA Region: VI

Person(s) in charge of the facility: Neil Packard

Name of Reviewer: Date:

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

Abandoned landfill previously owned and operated by the City of Freeport, Texas. See attached work sheets and footnotes for further details.

Scores: $S_M = 1.75$ ($S_{gw} = 0.82$ $S_{sw} = 2.91$ $S_a = 0$)

$S_{FE} =$ N/A

$S_{DC} = 0.56$

Ground Water Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern (1)*	0 1 2 (3)	2	6	6	
Net Precipitation (2)	0 (1) 2 3	1	1	3	
Permeability of the Unsaturated Zone (3)	0 (1) 2 3	1	1	3	
Physical State (27)	0 (1) 2 3	1	1	3	
Total Route Characteristics Score			9	15	
3 Containment (28)	0 1 (2) 3	1	2	3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence (29,7)	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity (30)	0 1 2 3 4 5 6 7 8	1	8	8	
Total Waste Characteristics Score			26	26	
5 Targets					3.5
Ground Water Use (9)	(0) 1 2 3	3	0	9	
Distance to Nearest Well/Population Served (10)	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			1	49	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			468	57,330	
7 Divide line 6 by 57,330 and multiply by 100		S_{gw} = 0.82			

*See footnotes for typed parenthetical numbers.

Landfill

Surface Water Route Work Sheet					
Rating Factor	**Assigned Value (Circle One)**	**Multi-plier**	**Score**	**Max. Score**	**Ref. (Section)**
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain (11,31)	0 1 (2) 3	1	2	3	
1-yr. 24-hr. Rainfall (13)	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water (31)	0 1 2 (3)	2	6	6	
Physical State (27)	0 (1) 2 3	1	1	3	
Total Route Characteristics Score			12	15	
3 Containment (28)	(0) 1 2 3	1	1	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence (29,7)	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity (30)	0 1 2 3 4 5 6 7 (8)	1	8	8	
Total Waste Characteristics Score			26	26	
5 Targets					4.5
Surface Water Use (14)	(0) 1 2 3	3	0	9	
Distance to a Sensitive Environment (15)	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream (16)	(0) 4 6 8 10 / 12 16 18 20 / 24 30 32 35 40	1	0	40	
Total Targets Score			6	55	
6 If line 1 is 45, multiply 1 x 4 x 5. If line 1 is 0, multiply 2 x 3 x 4 x 5			1,872	64,350	
7 Divide line 6 by 64,350 and multiply by 100	S_{sw} = 2.91				

Air Route Work Sheet					
Rating Factor	**Assigned Value (Circle One)**	**Multi-plier**	**Score**	**Max. Score**	**Ref. (Section)**
1 Observed Release	0 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line 1 is 0, the S_a = 0. Enter on line 5. If line 1 is 45, then proceed to line 2.					
2 Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score				20	
3 Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
Total Targets Score				39	
4 Multiply 1 x 2 x 3				35,100	
5 Divide line 4 by 35,100 and multiply by 100		S_a =	0		

Landfill

	s	s^2
Groundwater Route Score (S_{gw})	0.82	0.67
Surface Water Route Score (S_{sw})	2.91	8.47
Air Route Score (S_a)	0	0
$S^2_{gw} + S^2_{sw} + S^2_a$		9.14
$\sqrt{S^2_{gw} + S^2_{sw} + S^2_a}$		3.02
$\sqrt{S^2_{gw} + S^2_{sw} + S^2_a} / 1.73 = S_M =$		1.75

Fire and Explosion Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Containment	1 3	1		3	7.1
2 Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
3 Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
	Total Targets Score			24	
4 Multiply 1 x 2 x 3				1,440	
5 Divide line 4 by 1,440 and multiply by 100		S_{FE} = N/A (17)			

Direct Contact Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Incident	(0) 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2					
2 Accessibility (18)	(0) 1 2 3	1	1	3	8.2
3 Containment (28)	(0) 15	1	1	15	8.3
4 Waste Characteristics Toxicity (29)	0 1 2 (3)	5	15	15	8.4
5 Targets					8.5
Population Within a 1-Mile Radius (20)	0 1 (2) 3 4 5	4	8	20	
Distance to a Critical Habitat (21)	(0) 1 2 3	4	0	12	
Total Targets Score			8	32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			120	21,600	
7 Divide line 6 by 21,600 and multiply by 100			S_{DC} = 0.56		

Facility name: Bryan Mound SPR Facility

Location: Freeport, Texas

EPA Region: VI

Person(s) in charge of the facility: Neil Packard

Name of Reviewer: ____________ Date: ____________

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

North Tar Pit abandoned at this facility prior to purchase by DOE. Tar is believed to be weathered petroleum products. See attached worksheets and footnotes for further details.

Scores: $S_M = 2.97$ ($S_{gw} = 1.04$ $S_{sw} = 5.04$ $S_a = 0$)

$S_{FE} =$ N/A

$S_{DC} = 8.33$

Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern (1) *	0 1 2 (3)	2	6	6	
Net Precipitation (2)	0 (1) 2 3	1	1	3	
Permeability of the Unsaturated Zone (3)	0 (1) 2 3	1	1	3	
Physical State (4)	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			11	15	
3 Containment (22)	0 1 2 (3)	1	3	3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence (32,7)	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity (33)	(0) 1 2 3 4 5 6 7 8	1	0	8	
Total Waste Characteristics Score			18	26	
5 Targets					3.5
Ground Water Use (9)	(0) 1 2 3	3	0	9	
Distance to Nearest Well/Population Served (10)	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			1	49	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			594	57,330	
7 Divide line 6 by 57,330 and multiply by 100		S_{gw} = 1.04			

*See footnotes for typed parenthetical numbers.

Surface Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain (11, 34)	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall (13)	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water (34)	0 1 (2) 3	2	4	6	
Physical State (4)	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			10	15	
3 Containment (22)	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence (32, 7)	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity (33)	(0) 1 2 3 4 5 6 7 8	1	0	8	
Total Waste Characteristics Score			18	26	
5 Targets					4.5
Surface Water Use (14)	(0) 1 2 3	3	0	9	
Distance to a Sensitive Environment (15)	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream (16)	(0) 4 6 8 10 / 12 16 18 20 / 24 30 32 35 40	1	0	40	
Total Targets Score			6	55	
6 If line 1 is 45, multiply 1 x 4 x 5; If line 1 is 0, multiply 2 x 3 x 4 x 5			3,240	64,350	
7 Divide line 6 by 64,350 and multiply by 100	S_{sw} = 5.04				

North Tar Pit

Air Route Work Sheet					
Rating Factor	**Assigned Value (Circle One)**	**Multi-plier**	**Score**	**Max. Score**	**Ref. (Section)**
1 Observed Release	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line 1 is 0, the S_a = 0. Enter on line 5. If line 1 is 45, then proceed to line 2.					
2 Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
3 Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
4 Multiply 1 x 2 x 3				35,100	
5 Divide line 4 by 35,100 and multiply by 100	S_a = 0				

North Tar Pit

	S	S^2
Groundwater Route Score (S_{gw})	1.04	1.08
Surface Water Route Score (S_{sw})	5.04	25.40
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		26.48
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		5.15
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		2.97

North Tar Pit

Fire and Explosion Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
$\boxed{1}$ Containment	1 3	1		3	7.1
$\boxed{2}$ Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score				20	
$\boxed{3}$ Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Total Targets Score				24	
$\boxed{4}$ Multiply $\boxed{1}$ x $\boxed{2}$ x $\boxed{3}$				1,440	
$\boxed{5}$ Divide line $\boxed{4}$ by 1,440 and multiply by 100		S_{FE} =	N/A (17)		

Direct Contact Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Incident (35)	(0) 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2					
2 Accessibility (18)	(0) 1 2 3	1	1	3	8.2
3 Containment (22)	0 (15)	1	15	15	8.3
4 Waste Characteristics Toxicity (32)	0 1 2 (3)	5	15	15	8.4
5 Targets					8.5
Population Within a 1-Mile Radius (20)	0 1 (2) 3 4 5	4	8	20	
Distance to a Critical Habitat (21)	(0) 1 2 3	4	0	12	
Total Targets Score			8	32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			1,800	21,600	
7 Divide line 6 by 21,600 and multiply by 100	S_{DC} = 8.33				

FOOTNOTES

1. The depth to unconfined groundwater is estimated at 10 to 15 ft. Numerous wells drilled at the Bryan Mound salt dome have produced only brackish, nonpotable water between the salt plug and surface.

2. From the Code of Federal Regulations, Title 40, Part 300, Appendix A Figures 4 and 5.

3. Based on the soil description from construction test boring number 3-6 performed on 6/23/77 by Law Engineering of Houston, Texas. This boring is considered representative of the Bryan Mound facility.

4. Since DOE did not operate this waste site a worst case assumption of liquid waste is assumed.

5. A moderately permeable, compatible natural liner is assumed based on the continual presence of standing water in this aboveground impoundment. Runoff diversion is considered adequate but dike containment freeboard is considered inadequate.

6. Cyanide (112.9 ppm), the only organic priority pollutant, and antimony (28.7 ppm), 1 of 8 inorganic priority pollutants, which were detected in concentrations exceeding 1 ppm are the basis of toxicity and persistence ratings. Toxicity of both compounds is rated high by Sax, 5th Edition (see Appendix $A_{(2)}$, Table 6).

7. Priority pollutant metals were extracted from the soil samples using a total acid digestion in accordance with the EPA Contract Laboratory Program for Inorganics. The concentration of metals detected are thus significantly higher than values expected for an EP Toxicity procedure due to extraction of bound and geological metals.

8. Quantity is based on total priority pollutants detected in concentrations greater than 1 ppm. These total surface impoundment pollutants have an aggregate concentration of 273.3 ppm (Table 1) contaminating 2,800 cu. yds. (40 yds. x 70 yds. x 1 yd.). When converted to tons, in accordance with Appendix $A_{(2)}$, Section 3.4, total pollutants are estimated at 0.77 tons.

9. This facility has saline, unconfined groundwater and is surrounded by coastal wetlands. No freshwater has been located at this facility despite drilling of multiple wells.

10. Since this groundwater is saline, zero population is served.

11. The average facility slope (0.6%) is based on the facility being 15 ft. above sea level at the center, sea level at the perimeter and 5,000 ft. from East to West and North to South.

12. The intervening terrain slope (1.5%) is based on the impoundment being 15 ft. above sea level and 1025 ft. N.W. of Mud Lake, at sea level.

13. Figure 8 of Appendix $A_{(2)}$ indicates 4 in.

14. Mud Lake and the Intracoastal Waterway are located within 3 miles (downstream). These water bodies are periodically fished.

15. The Bryan Mound facility is surrounded by coastal wetlands.

16. There are no identified intakes in saline Mud Lake or the chute connecting it to the Intracoastal Waterway (approximately 1 mile downstream).

17. This abandoned site has neither been certified as a hazard by a state or Federal fire marshal, nor have detectable levels of combustible gas been observed (reference Appendix $A_{(2)}$, Section 7.0).

18. The entire Bryan Mound facility is surrounded by a six foot chain link fence topped with barbed wire. Guards routinely patrol this facility and control access around the clock.

19. This impoundment has no cover or containerized wastes.

20. It is estimated that slightly over 100 people are employed at the Bryan Mound facility and the few surrounding facilities within a 1 mile radius.

21. No Federally endangered or threatened species have been identified within 1 mile of the Bryan Mound facility.

22. This waste site is at ground level with no liner, no flow diversion to prevent runon or ponding, no surface cover and no dikes for containment.

23. Pyrene (2.1 ppm), 1 of 2 organic priority pollutants and copper (4.6 ppm) 1 of 4 inorganic priority pollutants, detected in concentrations exceeding 1 ppm, are the basis of toxicity and persistence ratings. Toxicity of both compounds is rated high by Sax, 5th Edition (see Appendix $A_{(2)}$, Table 6).

24. Quantity is based on total priority pollutants detected in concentrations greater than 1 ppm. These waste site pollutants have a total aggregate concentration of 216.0 ppm (Table 1) contaminating 3,500 cu. yds. (35 yds. x 50 yds. x 2 yds.). When converted to tons, in accordance with Appendix $A_{(2)}$, Section 3.4, total pollutants are estimated at 0.76 tons.

25. The intervening terrain slope (5%) is based on the tar pit being 15 ft. above sea level and located 100 ft. N.W. of a small, on site surface water body located 10 ft above sea level.

26. The on site surface receiving water has no current use.

27. As a municipal landfill most wastes are expected to have been deposited as unstabilized solids.

28. This waste site is at ground level to slightly mounded with an earthen cover placed over it at closure by the City of Freeport.

29. No organic compounds were detected in quantities exceeding 1 ppm. Toxicity and persistence is based on lead (1 of 9 priority pollutant metals) present at 45.8 ppm. Toxicity is rated high by Sax, 5th Edition (see Appendix $A_{(2)}$, Table 6).

30. Quantity is based on the total priority pollutants detected in concentrations greater than 1 ppm. These total abandoned landfill pollutants have an aggregate concentration of 258.8 ppm (Table 1) contaminating 333,960 cu. yds. (23 acres x 3 yds.). When converted to tons, in accordance with Appendix $A_{(2)}$, Section 3.4. total pollutants are estimated at 86.4 tons. This total pollutant estimate is expected to have low precision and be extremely conservative due to expected landfill heterogeneity and the detection of bound and geological metals as described in footnote 7. No organic priority pollutants were detected at this site.

31. The intervening slope (10%) is based on the landfill being 5 ft. above sea level and located within 50 ft. of Mud Lake, at sea level.

32. Anthracene (65.0 ppm), 1 of 9 organic priority pollutants, and lead (33.2 ppm), 1 of 7 inorganic priority pollutants, which were detected in concentrations exceeding 1 ppm, are the basis of toxicity and persistence ratings. Toxicity of both compounds is rated high by Sax, 5th Edition (see Appendix $A_{(2)}$, Table 6).

33. Quantity is based on the total priority pollutants detected in concentrations greater than 1 ppm. These waste site pollutants have a total aggregate concentration of 373 ppm (Table 1) contaminating 450 cu. yds. (15 yds. x 15 yds. x 2 yds.). When converted to tons, in accordance with Appendix $A_{(2)}$, Section 3.4, total pollutants are estimated at 0.17 tons.

34. The intervening slope (0.8%) is based on this waste site being 15 ft. above sea level and located 1900 ft. West of Mud Lake, at sea level.

35. In 1978 during early construction of the Bryan Mound facility several head of cattle wandered into this abandoned tar pit and became stranded. These cattle were sacrificed because mechanical removal was inhumane while they were alive, not because they were suffering from toxic effects of contact with this tar pit. Access to this facility has since become controlled by fencing (see footnote 18) and the North Tar Pit was backfilled in 1980.

APPENDIX C

Ecology and Environment, Inc. Field Investigation Team

Report on the West Hackberry SPR Site

4

EPA

POTENTIAL HAZARDOUS WASTE SITE
FINAL STRATEGY DETERMINATION E.PA

REGION: 6
SITE NUMBER: LA 3727

File this form in the regional Hazardous Waste Log File and submit a copy to: U.S. Environmental Protection Agency; Site Tracking System; Hazardous Waste Enforcement Task Force (EN-335); 401 M St., SW; Washington, DC 20460.

I. SITE IDENTIFICATION

A. SITE NAME: West Hackberry Strategic Petroleum Reserve Project

B. STREET: 3.8 mi W. of Hackberry off Hwy. 390

C. CITY: Hackberry

D. STATE: LA

E. ZIP CODE: 70645

II. FINAL DETERMINATION

Indicate the recommended action(s) and agency(ies) that should be involved by marking 'X' in the appropriate boxes.

RECOMMENDATION	MARK 'X'	ACTION AGENCY: EPA	STATE	LOCAL	PRIVATE
A. NO ACTION NEEDED	X				
B. REMEDIAL ACTION NEEDED, BUT NO RESOURCES AVAILABLE (If yes, complete Section III.)					
C. REMEDIAL ACTION (If yes, complete Section IV.)					
D. ENFORCEMENT ACTION (If yes, specify in Part E whether the case will be primarily managed by the EPA or the State and what type of enforcement action is anticipated.)					

E. RATIONALE FOR FINAL STRATEGY DETERMINATION

Hazardous wastes not produced or disposed of on-site. Brine solutions disposed of off-shore under NPDES permit. FIT report of 6/25 indicates excellent industrial housekeeping.

F. IF A CASE DEVELOPMENT PLAN HAS BEEN PREPARED, SPECIFY THE DATE PREPARED (mo., day, & yr.).

G. IF AN ENFORCEMENT CASE HAS BEEN FILED, SPECIFY THE DATE FILED (mo., day, & yr.). —

7/25/85

H. PREPARER INFORMATION

1. NAME: Gregory J. McCabe

2. TELEPHONE NUMBER: (214) 767-9705

3. DATE (mo., day, & yr.): 7/22/85

III. REMEDIAL ACTIONS TO BE TAKEN WHEN RESOURCES BECOME AVAILABLE

List all remedial actions, such as excavation, removal, etc. to be taken as soon as resources become available. See instructions for a list of Key Words for each of the actions to be used in the spaces below. Provide an estimate of the approximate cost of the remedy.

A. REMEDIAL ACTION	B. ESTIMATED COST	C. REMARKS
	$	
	$	
	$	
	$	
	$	
	$	
	$	
	$	
D. TOTAL ESTIMATED COST	$	

EPA Form T2070-5 (10-79)

Continue On Reverse

R06-8503-15

EPA

P[illegible]ENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

REGION	SITE NUMBER (to be assigned by Hq)
06	LA ~~0109~~ 3727

GENERAL INSTRUCTIONS: Complete Sections I and III through XV of this form as completely as possible. Then use the information on this form to develop a Tentative Disposition (*Section II*). File this form in its entirety in the regional Hazardous Waste Log File. Be sure to include all appropriate Supplemental Reports in the file. Submit a copy of the forms to: U.S. Environmental Protection Agency; Site Tracking System; Hazardous Waste Enforcement Tack Force (*EN-335*); 401 M St., SW; Washington, DC 20460.

I. SITE IDENTIFICATION

A. SITE NAME: West Hackberry Strategic Petroleum Reserve
B. STREET (or other identifier): P.O. Box 278
C. CITY: Hackberry
D. STATE: La.
E. ZIP CODE: 70645
F. COUNTY NAME: Cameron Parish

G. SITE OPERATOR INFORMATION
1. NAME: Boeing Petroleum Services
2. TELEPHONE NUMBER: (318) 436-0668
3. STREET: P.O. Box 278
4. CITY: Hackberry
5. STATE: La.
6. ZIP CODE: 70645

H. REALTY OWNER INFORMATION (if different from operator of site)
1. NAME: United States Department of Energy
2. TELEPHONE NUMBER: (318) 436-0668
3. CITY: Hackberry
4. STATE: La.
5. ZIP CODE: 70645

I. SITE DESCRIPTION: Primary Installation-U.S. Strategic Petroleum Reserve

J. TYPE OF OWNERSHIP
[x] 1. FEDERAL [ ] 2. STATE [ ] 3. COUNTY [ ] 4. MUNICIPAL [ ] 5. PRIVATE

PRELIMINARY REPORT
This does not constitute
final opinion of EPA.

II. TENTATIVE DISPOSITION (complete this section last)

A. ESTIMATE DATE OF TENTATIVE DISPOSITION (mo., day, & yr.):

B. APPARENT SERIOUSNESS OF PROBLEM
[ ] 1. HIGH [ ] 2. MEDIUM [ ] 3. LOW [x] 4. NONE

C. PREPARER INFORMATION
1. NAME: LGMichel
L. G. Michel, FIT
2. TELEPHONE NUMBER: (214) 742-6601
3. DATE (mo., day, & yr.): 6/25/85

III. INSPECTION INFORMATION

A. PRINCIPAL INSPECTOR INFORMATION
1. NAME: L. G. Michel
2. TITLE: Environmental Scientist, FIT
3. ORGANIZATION: Ecology And Environment, Inc., 1509 Main St., Dallas, Tx. 75201
4. TELEPHONE NO. (area code & no.): 214-742-6601

B. INSPECTION PARTICIPANTS

1. NAME	2. ORGANIZATION	3. TELEPHONE NO.
L. G. Michel	Ecology And Environment, Inc.	214-742-6601
R. J. Kratzke	Ecology And Environment, Inc.	214-742-6601

C. SITE REPRESENTATIVES INTERVIEWED (corporate officials, workers, residents)

1. NAME	2. TITLE & TELEPHONE NO.	3. ADDRESS
Michael Huff	Site Environmental Spec. 318-436-0668	P.O. Box 278, Hackberry, La. 70645
Bill E. Bozzo	Environmental Coordinator 318-436-0668	P.O. Box 278, Hackberry, La. 70645

PRELIMINARY REPORT
This does not constitute
final opinion of EPA.

Continued From Front

III. INSPECTION INFORMATION (continued)

D. GENERATOR INFORMATION (sources c… aste)

1. NAME	2. TELEPHONE NO.	3. ADDRESS	4. WASTE TYPE GENERATED
Strategic Petroleum Reserve	318-436-0668	P.O. Box 278, Hackberry, La., 70645	Brine; oily absorbents

E. TRANSPORTER/HAULER INFORMATION

1. NAME	2. TELEPHONE NO.	3. ADDRESS	4. WASTE TYPE TRANSPORTED
NA			

F. IF WASTE IS PROCESSED ON SITE AND ALSO SHIPPED TO OTHER SITES, IDENTIFY OFF-SITE FACILITIES USED FOR DISPOSAL.

1. NAME	2. TELEPHONE NO.	3. ADDRESS
NA		

G. DATE OF INSPECTION (mo., day, & yr.)	H. TIME OF INSPECTION	I. ACCESS GAINED BY: (credentials must be shown in all cases)
6/3/85	1330 hours	☒ 1. PERMISSION ☐ 2. WARRANT

J. WEATHER (describe)

Partly cloudy (60%); 90°F

IV. SAMPLING INFORMATION

A. Mark 'X' for the types of samples taken and indicate where they have been sent e.g., regional lab, other EPA lab, contractor, etc. and estimate when the results will be available.

1. SAMPLE TYPE	2. SAMPLE TAKEN (mark 'X')	3. SAMPLE SENT TO:	4. DATE RESULTS AVAILABLE
a. GROUNDWATER			
b. SURFACE WATER			
c. WASTE			
d. AIR			
e. RUNOFF			
f. SPILL			
g. SOIL			
h. VEGETATION			
i. OTHER (specify)	X	No samples taken during inspection	

B. FIELD MEASUREMENTS TAKEN (e.g., radioactivity, explosivity, PH, etc.)

1. TYPE	2. LOCATION OF MEASUREMENTS	3. RESULTS
None		

 Continue On Page 3

Continued From Page 2

IV. SAMPLING INFORMATION (continued)

C. PHOTOS

1. TYPE OF PHOTOS: [X] a. GROUND [ ] b. AERIAL
2. PHOTOS IN CUSTODY OF: EPA, Region VI (attached)

D. SITE MAPPED?

[X] YES. SPECIFY LOCATION OF MAPS: U.S.G.S. 7½' Topographic Sheet (attached)

E. COORDINATES

1. LATITUDE (deg.-min.-sec.): 30° 59' 47" N
2. LONGITUDE (deg.-min.-sec.): 93° 24' 36" W

V. SITE INFORMATION

A. SITE STATUS

[X] 1. ACTIVE (Those industrial or municipal sites which are being used for waste treatment, storage, or disposal on a continuing basis, even if infrequently.)

[ ] 2. INACTIVE (Those sites which no longer receive wastes.)

[ ] 3. OTHER (specify): (Those sites that include such incidents like "midnight dumping" where no regular or continuing use of the site for waste disposal has occurred.)

B. IS GENERATOR ON SITE?

[ ] 1. NO [X] 2. YES (specify generator's four-digit SIC Code): NA

C. AREA OF SITE (in acres): 565

D. ARE THERE BUILDINGS ON THE SITE?

[ ] 1. NO [X] 2. YES (specify): Maintenance operations security

VI. CHARACTERIZATION OF SITE ACTIVITY

Indicate the major site activity(ies) and details relating to each activity by marking 'X' in the appropriate boxes.

'X'	A. TRANSPORTER	'X'	B. STORER	'X'	C. TREATER	'X'	D. DISPOSER
	1. RAIL		1. PILE		1. FILTRATION		1. LANDFILL
	2. SHIP		2. SURFACE IMPOUNDMENT		2. INCINERATION		2. LANDFARM
	3. BARGE		3. DRUMS		3. VOLUME REDUCTION		3. OPEN DUMP
	4. TRUCK		4. TANK, ABOVE GROUND		4. RECYCLING/RECOVERY		4. SURFACE IMPOUNDMENT
	5. PIPELINE		5. TANK, BELOW GROUND		5. CHEM./PHYS./TREATMENT		5. MIDNIGHT DUMPING
	6. OTHER (specify):		6. OTHER (specify):		6. BIOLOGICAL TREATMENT		6. INCINERATION
					7. WASTE OIL REPROCESSING		7. UNDERGROUND INJECTION
					8. SOLVENT RECOVERY	X	8. OTHER (specify): Ocean (Gulf of Mexico) disposal
					9. OTHER (specify):		

E. SUPPLEMENTAL REPORTS: If the site falls within any of the categories listed below, Supplemental Reports must be completed. Indicate which Supplemental Reports you have filled out and attached to this for..

[ ] 1. STORAG. [ ] 2. INCINERATION [ ] 3. LANDFILL [ ] 4. SURFACE IMPOUNDMENT [ ] 5. DEEP WELL

[ ] 6. CHEM/BIO/PHYS TREATMENT [ ] 7. LANDFARM [ ] 8. OPEN DUMP [ ] 9. TRANSPORTER [ ] 10. RECYCLOR/RECLAIMER

VII. WASTE RELATED INFORMATION

A. WASTE TYPE

[X] 1. LIQUID [X] 2. SOLID [ ] 3. SLUDGE [ ] 4. GAS

B. WASTE CHARACTERISTICS

[ ] 1. CORROSIVE [ ] 2. IGNITABLE [ ] 3. RADIOACTIVE [ ] 4. HIGHLY VOLATILE

[ ] 5. TOXIC [ ] 6. REACTIVE [ ] 7. INERT [ ] 8. FLAMMABLE

[X] 9. OTHER (specify): Concentrated Brine (98-99% NACL); oily absorbents

C. WASTE CATEGORIES

1. Are records of wastes available? Specify items such as manifests, inventories, etc. below.

Brine pumping records available; manifests available

Continue On Reverse

Continued From Front

WASTE RELATED INFORMATION (continued)

2. Estimate the amount (specify unit of measure) of waste by category; mark 'X' to indicate which wastes are present.

	a. SLUDGE	b. OIL	c. SOLVENTS	d. CHEMICALS	e. SOLIDS	f. OTHER
AMOUNT	None	None	None	None	75	None
UNIT OF MEASURE					yd3 year	

'X'	a. SLUDGE	'X'	b. OIL	'X'	c. SOLVENTS	'X'	d. CHEMICALS	'X'	e. SOLIDS	'X'	f. OTHER
	(1) PAINT, PIGMENTS		(1) OILY WASTES		(1) HALOGENATED SOLVENTS		(1) ACIDS		(1) FLYASH		(1) LABORATORY, PHARMACEUT.
	(2) METALS SLUDGES		(2) OTHER(specify):		(2) NON-HALOGNTD. SOLVENTS		(2) PICKLING LIQUORS		(2) ASBESTOS		(2) HOSPITAL
	(3) POTW				(3) OTHER(specify):		(3) CAUSTICS		(3) MILLING/MINE TAILINGS		(3) RADIOACTIVE
	(4) ALUMINUM SLUDGE						(4) PESTICIDES		(4) FERROUS SMELTING WASTES		(4) MUNICIPAL
	(5) OTHER(specify):						(5) DYES/INKS		(5) NON-FERROUS SMLTG. WASTES		(5) OTHER(specify):
							(6) CYANIDE	x	(6) OTHER(specify): Oily Absorbents		
							(7) PHENOLS				
							(8) HALOGENS				
							(9) PCB				
							(10) METALS				
							(11) OTHER(specify):				

D. LIST SUBSTANCES OF GREATEST CONCERN WHICH ARE ON THE SITE (place in descending order of hazard)

1. SUBSTANCE	2. FORM (mark 'X') a. SOLID	b. LIQ.	c. VAPOR	3. TOXICITY (mark 'X') a. HIGH	b. MED.	c. LOW	d. NONE	4. CAS NUMBER	5. AMOUNT	6. UNIT
None										

VIII. HAZARD DESCRIPTION

FIELD EVALUATION HAZARD DESCRIPTION: Place an 'X' in the box to indicate that the listed hazard exists. Describe the hazard in the space provided.

☐ A. HUMAN HEALTH HAZARDS

Continue On Page 5

Continued From Page 4

VIII. HAZARD DESCRIPTION (continued)

☐ B. NON-WORKER INJURY/EXPOSURE

☐ C. WORKER INJURY/EXPOSURE

☐ D. CONTAMINATION OF WATER SUPPLY

☐ E. CONTAMINATION OF FOOD CHAIN

☐ F. CONTAMINATION OF GROUND WATER

☐ G. CONTAMINATION OF SURFACE WATER

 Continue On Reverse

Continued From Front

VIII. HAZARD DESCRIPTION *(continued)*

☐ H. DAMAGE TO FLORA/FAUNA

☐ I. FISH KILL

☐ J. CONTAMINATION OF AIR

☐ K. NOTICEABLE ODORS

☐ L. CONTAMINATION OF SOIL

☐ M. PROPERTY DAMAGE

Continue On Page 7

Continued From Page 6

VIII. HAZARD DESCRIPTION (continued)

[x] N. FIRE OR EXPLOSION

Sabotage of a Strategic Petroleum Reserve facility could potentially cause fire/ explosion. Elaborate security system mitigates against saboteurs

[x] O. SPILLS/LEAKING CONTAINERS/RUNOFF/STANDING LIQUID

Absorbents used to clean up minor spills/leaks of crude oil.

[ ] P. SEWER, STORM DRAIN PROBLEMS

[ ] Q. EROSION PROBLEMS

[ ] R. INADEQUATE SECURITY

[ ] S. INCOMPATIBLE WASTES

VIII. HAZARD DESCRIPTION (continued)

☐ T. MIDNIGHT DUMPING

☒ U. OTHER (specify):

The Hackberry, La., site is the primary facility in the U.S.D.O.E.'s Strategic Petroleum Reserve. Beginning in 1977, salt dome formations beneath the site have been solution mined using pressurized water. This process forms enormous salt caverns in which the DOE stores domestic and imported crude oil as insurance against a foreign embargo or national petroleum short fall.

Brine produced by solution mining is pumped via pipeline for disposal 6-8 miles offshore in the Gulf of Mexico. No wastes and no waste-producing processes were observed on-site during the inspection. The site exhibited excellent industrial housekeeping and very stringent security.

No further action is recommended by the FIT.

IX. POPULATION DIRECTLY AFFECTED BY SITE

A. LOCATION OF POPULATION	B. APPROX. NO. OF PEOPLE AFFECTED	C. APPROX. NO. OF PEOPLE AFFECTED WITHIN UNIT AREA	D. APPROX. NO. OF BUILDINGS AFFECTED	E. DISTANCE TO SITE (specify units)
1. IN RESIDENTIAL AREAS	1300	1300	400	1.5 mi
2. IN COMMERCIAL OR INDUSTRIAL AREAS	0	0	0	0
3. IN PUBLICLY TRAVELLED AREAS	0	0	0	0
4. PUBLIC USE AREAS (parks, schools, etc.)	50	50	2	.5 mi

X. WATER AND HYDROLOGICAL DATA

A. DEPTH TO GROUNDWATER (specify unit)	B. DIRECTION OF FLOW	C. GROUNDWATER USE IN VICINITY
500'	North	Drinking water; Agriculture
D. POTENTIAL YIELD OF AQUIFER	**E. DISTANCE TO DRINKING WATER SUPPLY (specify unit of measure)**	**F. DIRECTION TO DRINKING WATER SUPPLY**
996, 300 gpd	1.5 mi	East

G. TYPE OF DRINKING WATER SUPPLY

☐ 1. NON-COMMUNITY < 15 CONNECTIONS ☒ 2. COMMUNITY (specify town): Hackberry, La. > 15 CONNECTIONS

☐ 3. SURFACE WATER ☒ 4. WELL

Continue On Page 9

Continued From Page 8

X. WATER AND HYDROLOGICAL DATA *(continued)*

H. LIST ALL DRINKING WATER WELLS WITHIN A 1/4 MILE RADIUS OF SITE

1. WELL	2. DEPTH (specify unit)	3. LOCATION (proximity to population/buildings)	4. NON-COMMUNITY (mark 'X')	5. COMMUNITY (mark 'X')
None	-			

I. RECEIVING WATER

1. NAME: Black Lake

☐ 2. SEWERS ☐ 3. STREAMS/RIVERS ☐ 4. LAKES/RESERVOIRS ☒ 5. OTHER(specify): Bayou/marsh

6. SPECIFY USE AND CLASSIFICATION OF RECEIVING WATERS

Non-contact recreation; propagation of fish and wildlife

XI. SOIL AND VEGITATION DATA

LOCATION OF SITE IS IN:

☐ A. KNOWN FAULT ZONE ☐ B. KARST ZONE ☐ C. 100 YEAR FLOOD PLAIN ☒ D. WETLAND

☐ E. A REGULATED FLOODWAY ☐ F. CRITICAL HABITAT ☐ G. RECHARGE ZONE OR SOLE SOURCE AQUIFER

XII. TYPE OF GEOLOGICAL MATERIAL OBSERVED

Mark 'X' to indicate the type(s) of geological material observed and specify where necessary, the component parts.

'X'	A. OVERBURDEN	'X'	B. BEDROCK *(specify below)*	'X'	C. OTHER *(specify below)*
				X	
	1. SAND				Entire site underlain by salt dome at 2000'
X	2. CLAY				
	3. GRAVEL				

XIII. SOIL PERMEABILITY

☐ A. UNKNOWN ☐ B. VERY HIGH *(100,000 to 1000 cm/sec.)* ☐ C. HIGH *(1000 to 10 cm/sec.)*

☐ D. MODERATE *(10 to .1 cm/sec.)* ☐ E. LOW *(.1 to .001 cm/sec.)* ☒ F. VERY LOW *(.001 to .00001 cm/sec.)*

G. RECHARGE AREA

☐ 1. YES ☒ 2. NO 3. COMMENTS: Recharge areas 30 miles North

H. DISCHARGE AREA

☒ 1. YES ☐ 2. NO 3. COMMENTS: Estuarine drainage to Gulf of Mexico

I. SLOPE

1. ESTIMATE % OF SLOPE: 0-1%

2. SPECIFY DIRECTION OF SLOPE, CONDITION OF SLOPE, ETC.: South as coastal plain, estuary

J. OTHER GEOLOGICAL DATA

NA

Continue On Reverse

Continued From Front

XIV. PERMIT INFORMATION

List all applicable permits held by the site and provide the related information.

A. PERMIT TYPE (e.g., RCRA, State, NPDES, etc.)	B. ISSUING AGENCY	C. PERMIT NUMBER	D. DATE ISSUED (mo., day, & yr.)	E. EXPIRATION DATE (mo., day, & yr.)	F. IN COMPLIANCE (mark 'X') 1. YES	2. NO	3. UNKNOWN
NPDES	EPA	LA0053031	8/22/84	8/21/89	X		

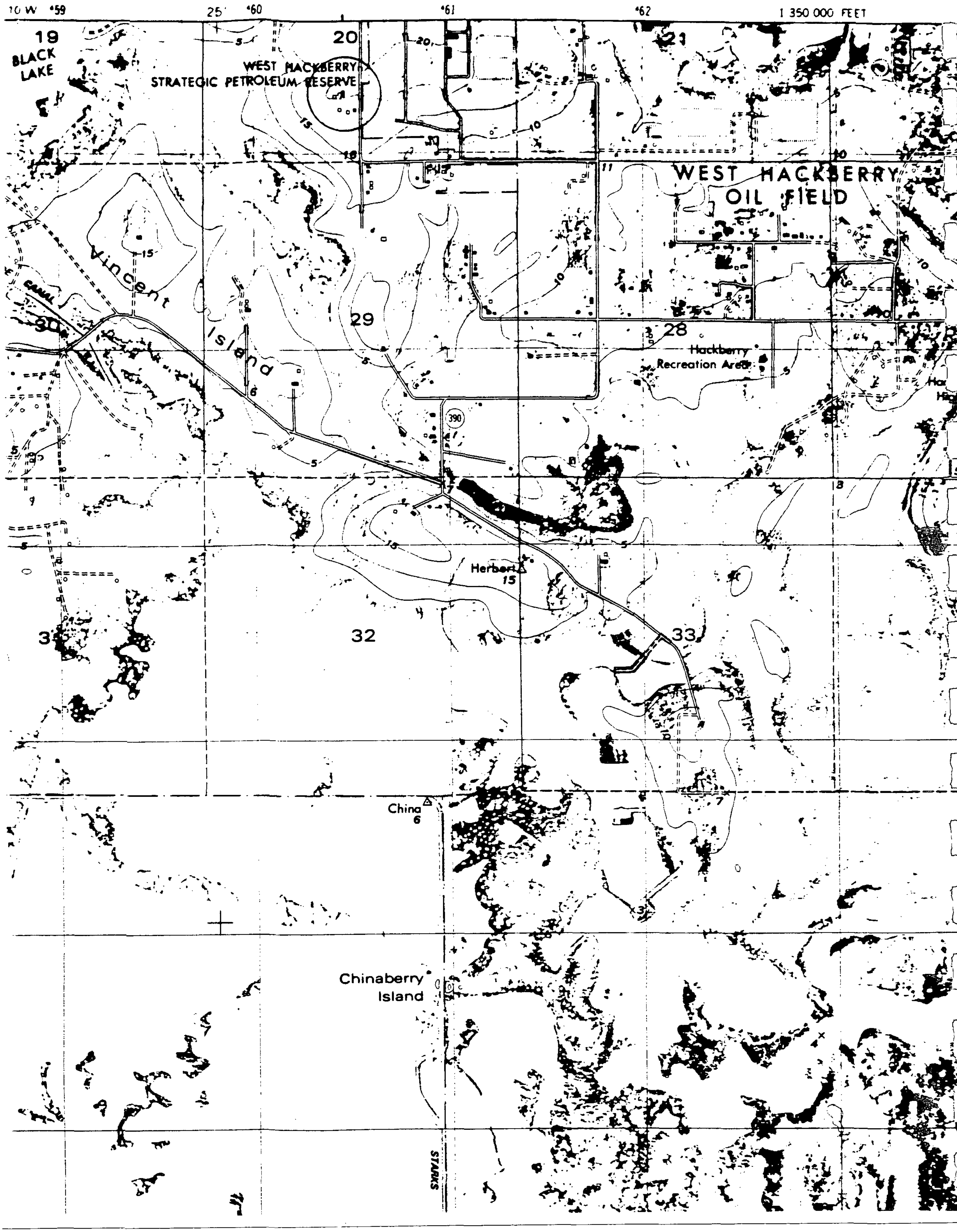
XV. PAST REGULATORY OR ENFORCEMENT ACTIONS

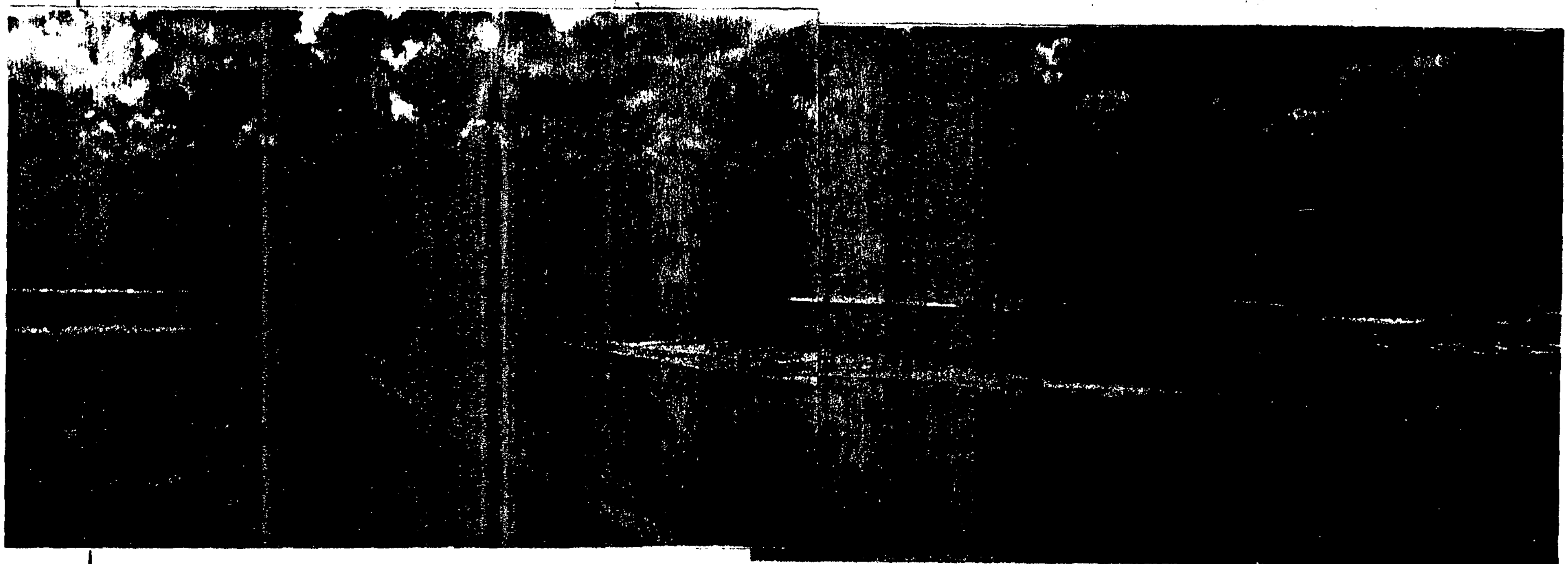
☐ NONE ☒ YES *(summarize in this space)*

Special "one-time" Generator permit (#LAP2-30051980) issued for disposal of approximately 5 gallons of reagent grade laboratory stock, principally benzene and benzyl chloride.

NOTE: Based on the information in Sections III through XV, fill out the Tentative Disposition *(Section II)* information on the first page of this form.

LOUISIANA–CAMERON PARISH
7.5 MINUTE SERIES ORTHOPHOTOMAP (TOPOGR





Overlay sheet 2

Photographer / Witness

L6MICHEL

Date / Time / Direction

6/3/05 1420 Facing NW

Comments:

Overlay sheet #2 at indicated line to provide site panorama.

Overlay sheet 3

Photographer / Witness

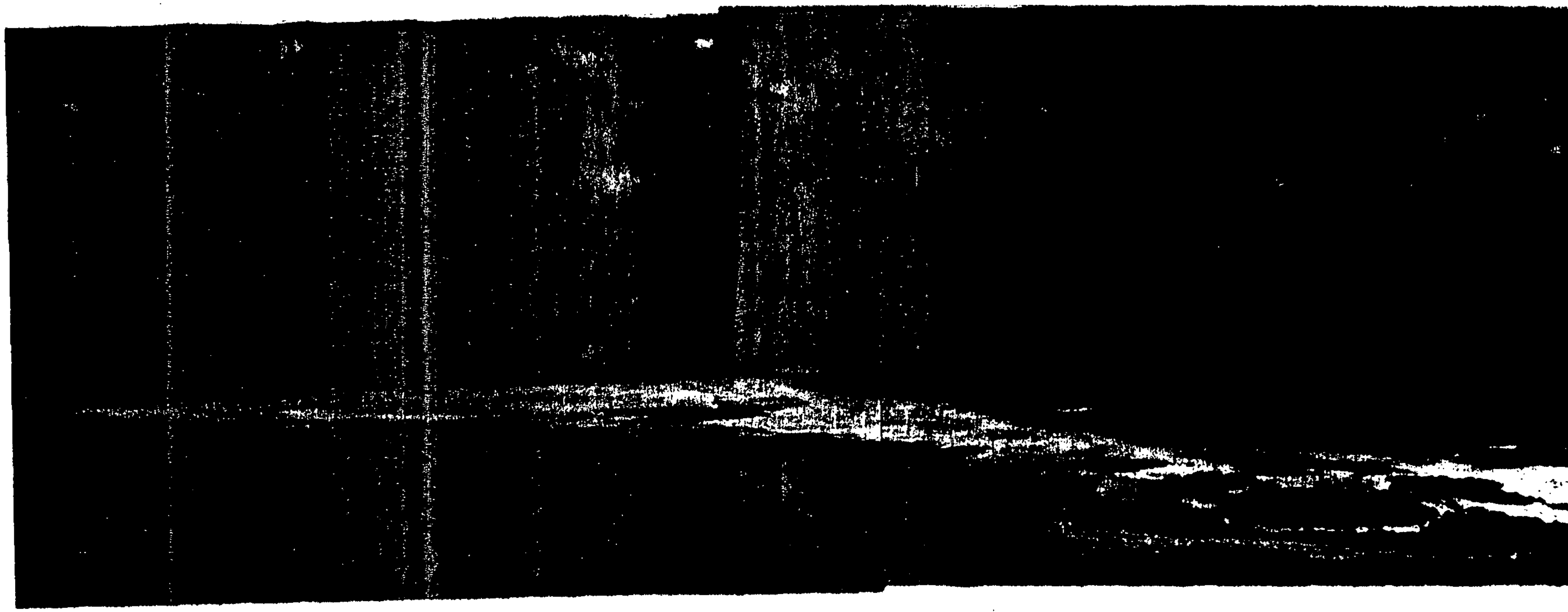
Lomueller

Date / Time / Direction

6/3/85 1420 Facing W

Comments:

Overlay onto sheet 1 where indicated to provide panorama of site.



Photographer / Witness

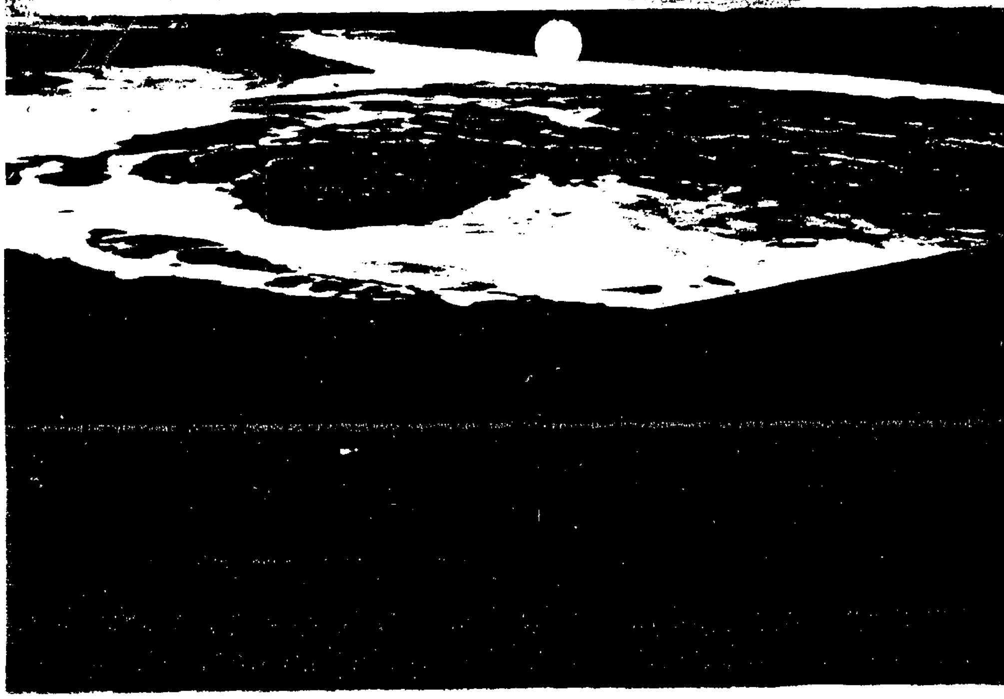
LGMICHEL

Date / Time / Direction

6/3/85 1420 Facing S

Comments:

Overlay onto Sheet 2 where indicated to provide site panorama.



Photographer / Witness

L Gruetter

Date / Time / Direction

6/3/85 1420 Facing West

Comments: Brine discharge from salt dome solution mining.

Photographer / Witness

Date / Time / Direction

Comments:

Photographer / Witness

Date / Time / Direction

Comments:

APPENDIX D

References

References

1. SPR Spill Report Files

2. SPR Permit Application and Correspondence Files

3. Waste Disposal Manifest Files

4. SPR Annual Environmental Monitoring Report, 1982 (124-83-AS-001)

5. SPR Annual Environmental Monitoring Report, 1983 (124-84-AS-001)

6. SPR Annual Environmental Monitoring Report, 1984 (124-84-AS-001)

7. SPR Annual Environmental Monitoring Report, 1985 (D506-01105-09)

8. Geological Site Characterization Report, Bayou Choctaw Salt Dome; G. H. Whiting, ed.; Sandia National Laboratories, 1980 (BC 5122.000 SAL)

9. Geological Site Characterization Report, Big Hill Salt Dome; G. H. Whiting, ed.; Sandia National Laboratories, 1981 (BH 5122.000 SAL)

10. Geological Site Characterization Report, Bryan Mound Salt Dome; G. H. Whiting, ed.; Sandia National Laboratories, 1980 (BM 5122.000 SAL)

11. Geological Site Characterization Report, Sulphur Mines Salt Dome; G. H. Whiting, ed.; Sandia National Laboratories, 1980 (SM 5122.000 SAL)

12. Geological Site Characterization Report, Weeks Island Salt Dome; G. H. Whiting, ed.; Sandia National Laboratories, 1980 (WI 5122.000 SAL)

13. Geological Site Characterization Report, West Hackberry Salt Dome; G. H. Whiting, ed.; Sandia National Laboratories, 1980 (WH 5122.000 SAL)

14. Final Environmental Impact Statement, Capline Group Salt Domes; U.S. DOE, 1978 (DOE/EIS-0024)

15. Final Environmental Impact Statement, Seaway Group Salt Domes; U.S. DOE, 1978 (DOE/EIS-0021)

16. Final Environmental Impact Statement, Sulphur Mines Salt Dome; U.S. DOE, 1978 (DOE/EIS-0010)

17. Final Environmental Impact Statement, Texoma Group Salt Domes; U.S. DOE, 1978 (DOE/EIS-0029)

18. SPR Well Histories (DOE Library ID #s; 6440 (Phase III); 6441 (Phase II); 6443 (Phase I Re-entry); 6442 (Brine Disposal))

19. Annual Technical Report for the Onshore Environmental Baseline Characterization; York Research Consultants, 1984 (DE-AC96-82P010391)

20. Land Use Survey; Bennett Abstract Company, 1986

21. Response to Technical Direction #143, Amendment 1, Bryan Mound Hazardous Waste Site Assessment, POSSI Document #CAO-84-688, 1984

22. Potential Hazardous Waste Site Inspection Report, West Hackberry, Ecology and Environment, 1985

23. Soil Survey of St. James and St. John the Baptist Parishes, Louisiana; U.S.D.A., 1973

24. IADC Daily Drilling Reports, all Big Hill wells

25. API Bulletin 13F: Oil and Gas Well Drilling Fluid Chemicals, American Petroleum Institute, 1978.

26. Letter: Department of Energy, March 28, 1985. Interpretation of Contract Provisions. M. McWilliams, Contracting Officer to M. Ovens, BPS Director of Contracts

27. Code of Federal Regulations, Title 40.

28. Visits were made to all SPR sites by the Installation Assessment Team. These visits included examination of the sites and interview of selected personnel. Personnel employed by former site owners were also interviewed as appropriate. A complete list of personnel interviewed for each site follows. In addition to DOE and BPS, personnel with Walk Haydel and Associates (WH&A), Parsons Brinckerhoff Kavern Bau-und-Betriebs-GMBH (PB-KBB), and other companies as indicated were interviewed.

A. Bayou Choctaw

Herman Barr (BPS)
Carl Budd (BPS)
David Donovan (NL Baroid)
Magdy Hanna (Jacobs/D'Appolonia Engineers)
J.C. Morris (DOE)
Doug Russell (BPS)
Charlie Webb (Allied Chemical)

B. Big Hill

Bill Cook (WH&A)
Hoot Gibson (DOE)
Tim Hewitt (BPS)
Ronnie Hughes (PB-KBB)
Clint Majors (Drillers Incorporated)

Bill Moses (WH&A)
Lou Trahan (WH&A)

C. Bryan Mound

Charles Bellam (DOE)
Herman Harris (BPS)
George Matula (Dow)
Bill O'Connell (PB-KBB)
Jim Salinas (BPS)
Leroy Schroller (BPS)
Karen Shubert (Dow)
Dan Tolleson (PB-KBB)

D. St. James

Chuck Everett (DOE)
Frank LeMoine (BPS)
Doug Russell (BPS)

E. Sulphur Mines

Brimstone Museum (Sulphur, LA)
Jon Culbert (DOE)
John Gabriel (PB-KBB)
Ben Guidry (BPS)
Mike Huff (BPS)
Gerald Labove (DOE)
Steve Lowery (BPS)
Doug Russell (BPS)
Vernon Sanner (Parsons-Gilbane)
Dwight Spates (Union Texas, retired)

F. Weeks Island

Dick Hebert (Morton Salt)
Gil Mix (Morton Salt)
Richard Phillips (BPS)
Norm Seifreit (BPS)
Elmer Thiele (DOE)

G. West Hackberry

Ben Guidry (BPS)
Mike Huff (BPS)
Gerald Labove (DOE)
Steve Lowery (BPS)

APPENDIX E

Qualifications of Installation Assessment Team

William E. Bozzo

Professional Experience:

- Developed and implemented the SPR Hazardous Waste Management Plan.
- Lead investigator in the Bryan Mound SPR investigation of abandoned industrial waste activity under EPA CERCLA, Texas CERCLA, and Texas RCRA waste programs.
- Provided lead technical guidance for retrofill and disposal of PCB and PCB-contaminated transformers and materials.
- Developed a fugitive volatile organic carbon compound monitoring program.
- Performed environmental audits for compliance with air, water, solid waste, hazardous waste and oilfield waste regulatory requirements.
- Supported development of EPA's Potomac River Waste Assimilation Model and EPA's Chesapeake Bay Study.
- Provided field support for EPA monitoring of the City of Philadelphia and Dupont Chemical ocean dumping sites (New York Bight).
- Provided marine physical and chemical characterization to the U.S. Navy Research laboratory in the North Atlantic Ocean.
- Developed and maintained Oil Spill Contingency Plans and Spill Prevention Control and Countermeasures Plans for six SPR sites.
- Provided field coordination for response and cleanup of oil and petroleum based product spills.
- Coordinated startup and operation of various wastewater treatment systems.

Education:

- M.B.A. General Management/Finance, 1986, Tulane University
- M.S. Environmental Science 1980, The American University
- B.A. Biology, 1977, Washington and Jefferson College

Christopher J. Upton

Professional Experience:

- Determined possible waste stream constituents and process by-products for a variety of chemical processes.
- Wrote portions of EPA Development Documents for the organic chemical and pesticide industries.
- Conducted treatability studies of an industrial wastestream.
- Compared methods to determine waste toxicity to biotreatment bacteria.
- Designed industrial wastewater treatment systems.
- Analyzed design of and proposed design modifications to municipal sewage treatment plants.
- Assessed hazardous, nonhazardous, and oilfield waste disposal facilities for a major corporation's oilfield waste disposal program.
- Prepared and implemented safety plans for hazardous waste site remedial action field investigations.
- Investigated National Priorities List (Superfund) hazardous waste sites for remedial action.
- Audited SPR facilities for air quality, water quality, solid waste, hazardous waste, and oilfield waste regulatory compliance.
- Reviewed SPR engineering proposals and designs for environmental compliance.

Education:

- B.S. Chemical Engineering, 1979, Tulane University
- Coursework complete for M.S.P.H. Environmental Health Science, Tulane University